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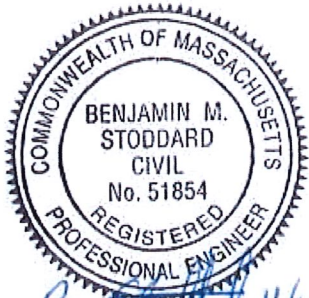
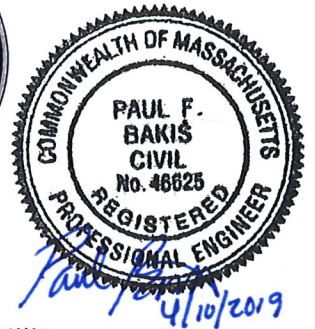
SPECIFICATIONS FOR THE CITY OF CAMBRIDGE, MASSACHUSETTS

INMAN SQUARE INTERSECTION SAFETY IMPROVEMENT PROJECT

Issued for Bid



CAMBRIDGE
DEPARTMENT
OF PUBLIC
**THE
WORKS**



In the City of Cambridge, Massachusetts

April 2019

Prepared By:

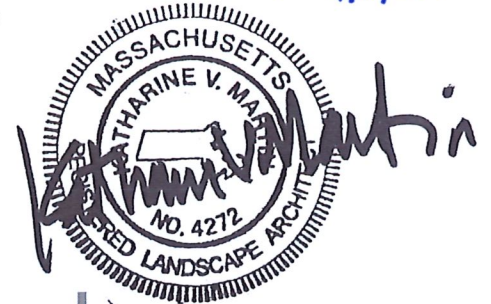


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INVITATION TO BID

The City of Cambridge, Massachusetts, the Awarding Authority, invites sealed bids for the project:

Inman Square Intersection Safety Improvement Project

Nature and scope of work:

The project area includes Hampshire Street between the Somerville City Line and Amory Street, Cambridge Street between Fayette Street and Oak Street, Springfield Street, the intersection of Cambridge Street and Antrim Street and the intersection of Hampshire Street and Inman Street.

The major components of work to be performed under this project include the following:

1. Installation of approximately 700 linear feet of 6-inch to 48-inch diameter Polyvinyl Chloride (PVC), Reinforced Concrete Pipe (RCP), and Ductile Iron (DI) storm drain, storm drain manholes, and catch basins.
2. Installation of approximately 1,100 linear feet of 6-inch, 8-inch and 12-inch diameter Ductile Iron (DI) water main. Installation of 6 hydrants. Reconnection and replacement of water services.
3. Installation of porous asphalt separated bicycle track and underdrain.
4. Roadway reconstruction of approximately 1,650 linear feet of roadway and sidewalks, full depth roadway construction, asphalt excavation by cold planer, pavement overlay, granite curbing, concrete sidewalk reconstruction, vehicle and bicycle pavement markings, signage, and bus shelters.
5. Installation of traffic, pedestrian and bicycle signals, mast arms, conduits and controls.
6. Installation of new lighting fixtures, including conduit, wiring, ground rod, and handholes. Refurbishment, maintenance and relocation of existing lighting fixtures. Disconnection and removal of existing light fixtures.
7. Reconstruction of the Springfield Street parking lot including a pedestrian access ramp with handrail, milling, paving and pavement markings, granite curbing, and landscaping.
8. Protection, preservation, and pruning of existing trees.
9. Tree pit preparation and planting of approximately 27 street trees.
10. Installation of hardscape and landscape elements in approximately 1,000 square feet of pedestrian plaza area. Hardscape includes landscape pavers, granite and wooden benches, landscape curb, lighting, and public artwork. Landscape includes installation of specialty soils, irrigation, and tree, shrub and groundcover plantings.

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

The estimated project value is: **\$6,100,000.00**

Specifications will be available from **8:30 a.m. to 8:00 p.m. on Monday, 8:30 a.m. to 5:00 p.m. Tuesday through Thursday, and 8:30 a.m. to Noon on Friday**, at the Purchasing Department, City Hall, 795 Massachusetts Avenue, Room 303, Cambridge, MA 02139 beginning **Thursday, April 11, 2019** or contact purchasing@cambridgema.gov for an electronic copy. For the mailing of the plans and specifications, the bidder must prepay a mailing and handling fee of \$5.00 per set.

All questions must be submitted in writing and either emailed to purchasing@cambridgema.gov or delivered to the Office of the Purchasing Agent, Elizabeth Unger, City Hall 795 Massachusetts Ave, Room 303, Cambridge, MA 02139 not later than Thursday, April 25, 2019 by 4:00 p.m. An Addendum will be issued to notify all bidders of the questions and answers.

The contract documents may be examined at the Office of the Purchasing Agent, room 303, City Hall, 795 Massachusetts Avenue, Cambridge, MA 02139.

Sealed general bids will be received at the Purchasing Department, City Hall, 795 Massachusetts Avenue, Room 303, Cambridge, MA 02139 until **Thursday May 9, 2019 at 2:00 PM** at which time all general bids will be publicly opened and read aloud.

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 general bidder will be required to furnish a Performance Bond, a Labor and Material (Payment) bond each for 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 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. OSHA Certification

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 must comply.

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

Date: April 18, 2019

Time: 9:00 AM

Place: Cambridge DPW Main Conference Room

147 Hampshire Street

Cambridge, MA 02139

Elizabeth Unger
Purchasing Agent

INFORMATION FOR AND INSTRUCTIONS TO BIDDERS

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 that 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 M.G.L. c. 30, §39M or c. 30B, as the case may be. The pronouns “it” and “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 of the forms (e.g., Bid forms, sample Agreement form, bond forms), the wage rates, the General Terms and Conditions 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.

OWNER- The term ‘Owner’, as used throughout the Contract Specification, refers to the City of Cambridge Public Work Department, and its designated personnel engineering the Contract.

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.

STATE WAGE RATE REQUIREMENTS

The minimum prevailing wage rates are included with the Bidding Documents and apply to this Project.

QUESTIONS AND INTERPRETATIONS

All questions about the meaning or intent of the Bidding Documents must be received in writing to the Purchasing Agent, Room 303, 795 Massachusetts Avenue, Cambridge MA 02139 or emailed to purchasing@cambridgema.gov before the date listed on the invitation to bid in the previous section. 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 emailed or mailed to all persons having received Bidding Documents from the Purchasing Department. All addendums are posted on our website.

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

THE BID

BIDDER'S REPRESENTATIONS.

In submitting a Bid, the Bidder represents that:

- It understands the Bidding Documents;
- It has read and examined the Bidding Documents thoroughly;
- 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) business 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.

A Bid must include:

- A completed Bid form;
- A Bid deposit;
- MBE Forms 1 and 2 or Forms 3 and 4 (City of Cambridge form);
- General Contractor's Form (City of Cambridge form);
- Projected Workforce Certification (City of Cambridge form and
- Notarized Statement of Bidder's Qualifications (City of Cambridge form)
Cambridge Responsible Employer Plan
OSHA Training Forms
- CORI Compliance Form
- Americans with Disabilities Act
- MA Diesel Retrofit Program Statement of Intent to Comply
- Wage Theft Prevention Certification

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 (5) 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 on, 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.

Bids Forms. Each Bid shall be submitted on the Bid form included in the Project Manual. Bid prices must be stated in both dollar figures and words. In the case of a conflict, written amounts shall control over numbers. All blank spaces must 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, the file number, the portion of the Work which the Bid represents, 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.

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, which is not accompanied by a Bid deposit.

COMPLETION/EXTENSION TIME

Bidder must agree to commence work on or before 7 days following the date set forth in the written "Notice to Proceed" to the Owner and to fully complete the project within **Five Hundred Thirty-Four (534) calendar days** from the date of Notice to Proceed thereafter. Bidder must agree also to pay as liquidated damages the sum of Five Thousand Three Hundred Sixty (\$5,360.00) dollars for each consecutive calendar day thereafter that the work remains unfinished.

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 ninety (90) 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 at least Three (3) 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.

ELIZABETH UNGER
PURCHASING AGENT

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 means and includes 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 of Cambridge Municipal Ordinance Section 2.66.060, et seq. 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 said 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 impositions of sanctions permitted by the Cambridge Municipal Code.
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 Section 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:

1. 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 Cambridge Employment Plan's employment standards;
2. Interviewed all qualified applicants and returned completed interview forms to ERI within one week of each respective interview;
3. It provided the City with the name and telephone number of the person designated as Compliance Officer to work directly with the City; and
4. It 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:

1. Placed its own ads in local and local minority newspapers or tabloids;
2. Placed a State Department Employment and Training ad.

CAMBRIDGE EMPLOYMENT PLAN

Article II. Construction Projects

2.66.060 Construction Projects - Worker Qualifications.

A. On any construction project which is funded in whole or in part by City, State or federal funds, or funds in which, in accordance with a federal grant, the City expends or administers, or in 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 of the total employee worker hours shall be performed by bona fide Cambridge Residents.
2. No less than twenty-five percent of the total employee worker hours shall be performed by minority persons.
3. No less than ten percent of the total employee worker hours shall be performed by women.

B. This section shall not apply to housing rehabilitation projects including eight or fewer. (Ord. 1053 (part), 1987; prior code § 24-6)

2.66.070 Compliance, enforcement, sanctions.

A. All contractors entering into construction contracts covered by Article II of this chapter shall:

1. Certify that they know of the provisions of said Article and that they intend to comply with them;
2. List all job openings with the Employment and Training Agency or Agencies and keep accurate records as to actions taken on referrals from these agencies;
3. Maintain personnel records listing the names, addresses, sex and race of their employees; and require their subcontractors to do likewise.

B. The Cambridge Community Development Department shall develop, in consultation with the Employment and Training Agency or Agencies, good-faith measures by which to judge the affirmative actions of contractors operating under the provisions of this Article II. All records required to be maintained by this section shall be made available on request to representatives to said Department. All such records shall be maintained for the duration of the construction project and for one year thereafter.

C. Should a contractor be deemed not to have complied with the provisions of this Article II, nor to have made a good-faith effort to do so, it shall not be actively considered for future public construction contracts in Cambridge. (Ord. 1053 (part), 1987; prior code § 24-7)

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 1I 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 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.

In City Council September 24, 2001.
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

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 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

Project:
Contract #:

**CAMBRIDGE RESPONSIBLE EMPLOYER PLAN
NON-FILED SUBCONTRACTOR CERTIFICATION - WEEKLY CONTRACT FORM**

_____ hereby certifies that it:
(Name of Subcontractor)

(1) complies 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) complies 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) maintains or participates 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) furnishes, 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) maintains appropriate industrial accident insurance coverage for all its employees employed on the project in accordance with M.G.L. c.152; and

(6) properly classifies 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 Subcontractor 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 subcontractor

Print name of authorized representative of subcontractor

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

ORDINANCE NUMBER 1376

Final Publication Number 3390. First Publication in the Chronicle on November 5, 2015.

City of Cambridge

In the Year Two Thousand and Fifteen

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 that the Municipal Code of the City of Cambridge be amended as follows:

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, but does not include a Covered Building Services Employer.

(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, other than a Covered Building Service Employee, 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.

(j) **“Covered Building Service Employee”** means any person performing building service work for a Covered Building Service Employer, either directly or through a contract or subcontract.

(k) **“Building Services” or “Building Service Work”** means work performed in connection with the cleaning of buildings and security guard services.

(l) **“Covered Building Service Contract”** means a contract or subcontract to provide Building Services to the City of Cambridge or any of its departments or subdivisions.

(m) **“Covered Building Service Contractor” or “Covered Building Service Employer”** means an entity providing Building Services on a Covered Building Service Contract or subcontract with the City or any of its departments or subdivisions.

(n) **“Standard Compensation”** has the meaning stated in Section 2.121.040.

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 “Standard Compensation”

(a) **Applicability.** Covered Building Services Employers shall pay no less than the Standard Compensation to Covered Building Service Employees.

(b) **Standard Compensation** shall include the standard hourly rate of pay for the relevant classification.

(c) **Amount.** (i) The “Standard Hourly Rate of Pay” for Covered Building Service Employees other than for security guards shall be the greatest of the following:

(1) The Living Wage rate as defined in 2.121.030; or

(2) the prescribed rate of wages as determined by the director of the department of labor standards pursuant to section 27H of chapter 149 of the General Laws of Massachusetts;

(ii) The “Standard Hourly Rate of Pay for security guards” shall be the greatest of the following:

(1) The Living Wage rate as defined in 2.121.030; or

(2) the prescribed rate of wages as determined by the director of the department of labor standards pursuant to section 3 of chapter 195 of the Massachusetts Acts of 2014; or

(3) the hourly rate paid to workers in the relevant classification under a preceding Building Service Contract.

(iii) The Standard Hourly Rate of Pay for Covered Building Service Employees other than for security guards shall be annually adjusted to be no less than the greatest of the following:

(1) the previous hourly rate of pay increased by the annual percentage difference between the current Boston-Lawrence-Salem, MA - NH Consumer Price Index (CPI) for all items for All Urban Consumers and the same CPI for the same month of the previous year, or

(2) the current prescribed rate of wages as determined by the director of the department of labor standards pursuant to section 27H of chapter 149 of the General Laws of Massachusetts.

(iv) The Standard Hourly Rate of Pay for security guards shall be annually adjusted to be no less than the greatest of the following:

(1) the previous hourly rate of pay increased by the annual percentage difference between the current Boston-Lawrence-Salem, MA - NH Consumer Price Index (CPI) for all items for All Urban Consumers and the same CPI for the same month of the previous year, or

(2) the current prescribed rate of wages as determined by the director of the department of labor standards pursuant to section 3 of chapter 195 of the Massachusetts Acts of 2014.

(v) “Standard Benefits” for Covered Building Service Employees other than for security guards shall be an hourly supplement furnished by a Covered Building Service Employer to a Covered Building Service Employee in one of the following ways: (1) in the form of health and other benefits (not including paid leave) that cost the Covered Building Service Employer the entire required hourly supplemental amount; (2) by providing a portion of the required hourly supplement in the form of health and other benefits (not including paid leave) and the balance in cash; or (3) by providing the entire supplement in cash. The required hourly supplemental rate shall be equal to the greatest of the following: (1) the monetary value of the health and other benefits (not including paid leave) provided under the prescribed rate of wages as determined by the director of the department of labor standards pursuant to section 27H of chapter 149 of the General Laws of Massachusetts; or (2) twenty percent (20%) of the standard hourly rate of pay.

(vii) “Standard Benefits for security guards” shall be an hourly supplement furnished by a Covered Building Service Employer to a Covered Building Service Employee in one of the following ways: (1) in the form of health and other benefits (not including paid leave) that cost the Covered Building Service Employer the entire required hourly supplemental amount; (2) by providing a portion of the required hourly supplement in the form of health and other benefits (not including paid leave) and the balance in cash; or (3) by providing the entire supplement in cash. The required hourly supplemental rate shall be equal to the greatest of the following: the monetary value of the health and other benefits (not including paid leave) provided under the prescribed rate of wages as determined by the director of the department of labor standards pursuant to section 3 of chapter 195 of the Massachusetts Acts of 2014; or (2) twenty percent (20%) of the standard hourly rate of pay.

(viii) For the purposes of this section, “benefits” shall not include workers compensation or other legally mandated insurance, nor shall it include the value of any benefit for which the Covered Building Service Employee is eligible, but for which no payment is actually made by a Covered Building Service Employer to the Covered Building Service Employee or to any other party on the Covered Building Service Employee’s behalf, because the Covered Building Service Employee either does not actually utilize or does not elect to receive the benefit for any reason

(ix) Standard benefits for Covered Building Service Employees other than for security guards shall be adjusted annually to be no less than equal to the value of the greatest of the following: (1) the value of the previous standard benefits increased by the annual percentage difference between the current Boston-Lawrence-Salem, MA - NH Consumer Price Index (CPI) for all items for All Urban Consumers and the same CPI for the same month of the previous year, or (2) the current monetary value of the health and other benefits (not including paid leave) provided under the prescribed rate of wages as determined by the director of the department of labor standards pursuant to section 27H of chapter 149 of the General Laws of Massachusetts.

(x) Standard benefits for security guards shall be adjusted annually to be no less than equal to the value of the greatest of the following: (1) the value of the previous standard benefits increased by the annual percentage difference between the current Boston-Lawrence-Salem, MA - NH Consumer Price Index (CPI) for all items for All Urban Consumers and the same CPI for the same month of the previous year, or (2) the current monetary value of the health and other benefits (not including paid leave) provided under the prescribed rate of wages as determined by the director of the department of labor standards pursuant to section 3 of chapter 195 of the Massachusetts Acts of 2014.

2.121.050 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. There shall be no waivers or exceptions made with respect to the Standard Compensation for Covered Building Service Employees.

(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.

2.121.060 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.

All Covered Building Service Contracts and all solicitations for Building Services issued by the City of Cambridge or any of its departments or subdivisions, shall contain a provision indicating the number of hours or work required and stating the Standard Compensation for the relevant classification that is applicable to the Covered Building Service Employees and shall contain a stipulation that the Covered building Service employees shall be paid not less than the Standard Compensation for the relevant classifications.

All requests for proposals or other solicitations and all specifications for Building Service Work, shall include specific reference to this chapter, shall state the required number of hours, and shall require prospective building service contractors to submit pricing on a standard worksheet furnished by the City that specifies the components of hourly pricing for the duration of the contract.

2.121.070 Duties of Covered Employers.

(a) Notification Requirements.

Covered employers and Covered Building Service 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 and notice of the Standard Compensation 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, or a Covered Building Service Contract, 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 or Standard Wage if applicable, as subject to adjustment under this ordinance and to comply with the provisions of this ordinance;
- (4) a list of Covered Employees and Covered Building Service 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.

(g) Payroll reporting. Every six (6) months, a Covered Building Service Employer, shall file with the City a complete certified payroll showing the Covered Building Service Employer's payroll records for each Covered Building Service Employee. Upon request, the Covered Building Service Employer shall produce for inspection and copying the payroll records for any or all applicable Covered Building Service Employees for the prior three (3) year period.

(h) Transitional Employment Period. The City shall give advance notice to a Covered Building Service Contractor and any collective bargaining representative of the Covered Building Service Contractor that a Covered Building Service Contract will be terminated, and the City shall also provide the name, address, and telephone number of the successor Covered Building Service Contractor or contractors where known. The terminated Covered Building Service Contractor shall, within five (5) days after receipt of such notice, provide to the successor Covered Building Service Contractor, the name, address, date of hire, and employment occupation classification of each employee employed at the site or sites covered by the building service contract at the time of receiving said notice. If a successor Covered Building Service Contractor has not been identified by the City by the end of the five (5) day pay period, the terminated Covered Building Service Contractor shall provide the information to the City, at the same time that the terminated contractor shall provide each affected employee with notice of his/her right to obtain employment with the successor Covered Building Service Contractor.

A successor Covered Building Service Contractor or subcontractor where applicable shall retain for a 90-day transitional employment period all employees who were employed by the terminated Covered Building Service Contractor and its subcontractors at the building(s) covered by the terminated contract. This requirement shall not apply in the event the City chooses to employ building service employees directly.

If at any time the successor Covered Building Service Contractor determines that fewer employees are required to perform the new service contract than had been performing such services under the terminated contract, the successor Covered Building Service Contractor shall retain the employees by seniority within job classification. Except for such layoffs, during the 90-day transition period, the successor Covered Building Service Contractor shall not discharge without cause an employee. During the 90-day transition period, the successor Covered Building Service Contractor shall maintain a preferential hiring list of those employees not retained from which the successor contractor or its subcontractors shall hire additional employees.

2.121.080 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)(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.

2.121.090 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.

2.121.100 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.

2.121.110 Effective Date.

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

In City Council December 21, 2015.
Passed to be ordained by a yeas and nays vote:-
Yeas 9; Nays 0; Absent 0; Present 0.
Attest:- Donna P. Lopez, City Clerk.

A true copy;

ATTEST:-

Donna P. Lopez
City Clerk

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.

For calendar year 2012 the CPI-U increased by 1.58%. Therefore the new living wage, as of March 1, 2013 is \$14.51.

For calendar year 2013 the CPI-U increased by 1.37%. Therefore the new living wage, as of March 1, 2014 is \$14.71.

For calendar year 2014 the CPI-U increased by 1.61% Therefore the new living wage, as of March 1, 2015 is \$14.95.

For calendar year 2015 the CPI-U increased by .06% Therefore the new living wage, as of March 1, 2016 is \$15.04.

For calendar year 2016 the CPI-U increased by 1.47% Therefore the new living wage, as of March 1, 2017 is \$15.26.

For calendar year 2017 the CPI-U increased by 2.51% Therefore the new living wage, as of March 1, 2018 is \$15.64

For calendar year 2018 the CPI-U increased by 3.29% Therefore the new living wage, as of March 1, 2019 is \$16.15.

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

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 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

FORM FOR GENERAL BID

To the Awarding Authority:

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

**Inman Square Intersection Safety Improvement 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.

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 respond to any of the following quality requirements will result in a rejection of your bid.

The bidder may utilize subcontractor's qualifications for responding to 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.

The bidder must provide references including telephone number and contact names from at least three locations where they are currently providing the same services for a municipality or other government entity. References will be used in determining the responsibility of the bidder. The city reserves the right to use itself as a reference

- | | | | |
|----|---|-----|----|
| 1. | Bidder has a minimum of ten (10) years' experience performing reconstruction of drains, water mains, sidewalks, and roadways for municipalities or public utilities. | YES | NO |
| 2. | 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 |
| 3. | The Bidder has reviewed the labor, equipment, and capacity requirements for its projected workload in Year(s) 2019-2020 and has determined that the Bidder has the resources to perform the work proposed in the project. | YES | NO |

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

Name of Bidder: _____

this Project, within 534 calendar days from the date in the "Notice to Proceed" thereafter.

E. Liquidated damages specified in this contract are **\$ 5,360.00** per day for each calendar day beyond the 534 calendar days from date set forth in the "Notice to Proceed".

F. The proposed contract price for the BID

is _____ DOLLARS
(Amount in Words)

(\$ _____)
(Amount in Figures)

G. The subdivision of the proposed contract price is as follows: (All quantities are approximate)

Item 2051.2 and 2080.1 through 2100.1 contain 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 inputted value. Insertion of 0 is allowable. In that case, the final unit cost will be the minimum unit cost.

Name of Bidder: _____

00300-2

BASE BID ITEMS

Item #	Estimated Quantity	Units	<u>ITEM DESCRIPTION</u> Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
1200.1	1	Lump Sum	Temporary Utility Support And Coordination _____ Dollars (\$ _____) Lump Sum	\$ _____
1200.2	1	Allowance	Bike Share Station Relocation Ten Thousand _____ Dollars (\$ 10,000.00 _____) Allowance	\$ 10,000.00 _____
1390.1	33	Each	External Building Inspection _____ Dollars (\$ _____) Each	\$ _____
1390.2	1	Allowance	Interior Building Inspection Five Thousand _____ Dollars (\$ 20,000.00 _____) Allowance	\$ 20,000.00 _____
1400.1	1	Allowance	Quality Control And Testing Ten Thousand _____ Dollars (\$ 10,000.00 _____) Allowance	\$ 10,000.00 _____
1500.1	1	Lump Sum	Temporary Ornamental Tree Lighting _____ Dollars (\$ _____) Lump Sum	\$ _____

Name of Bidder: _____

00300-3

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
1505.1	1	Lump Sum	Mobilization (Maximum 2% 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	160	Week	Remote Controlled Changeable Message Board _____ Dollars (\$ _____) Week	\$ _____
1570.3	12,000	Linear Feet	Temporary Roadway Striping _____ Dollars (\$ _____) Linear Feet	\$ _____
2015.1	1	Lump Sum	Vibration Monitoring _____ Dollars (\$ _____) Lump Sum	\$ _____
2051.1	2,800	Ton	Disposal Of Construction Debris As Solid Waste _____ Dollars (\$ _____) Ton	\$ _____

Name of Bidder: _____

00300-4

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
2051.2	2,500	Ton	Disposal Of Bituminous Concrete <u>Five</u> + _____ Dollars (\$ <u>5.00</u> + _____) Ton	\$ _____
2051.3	5	Each	Demolition Or Removal Of Lamp Hole, Manhole, Catch Basin Or Other Structure _____ Dollars (\$ _____) Each	\$ _____
2051.4	10	Each	Abandon In Place Manhole, Catch Basin Or Other Structure _____ Dollars (\$ _____) Each	\$ _____
2051.5	100	Ton	Disposal of Existing Railroad Ties _____ Dollars (\$ _____) Ton	\$ _____
2080.1	1	Lump Sum	OHM - Soil And Waste Management <u>Twenty Thousand</u> + _____ Dollars (\$ <u>20,000.00</u> + _____) Lump Sum	\$ _____
2095.1	2,000	Ton	OHM - Disposal Of Soil Less Than RCS-1 (Class A) <u>Ten</u> + _____ Dollars (\$ <u>10.00</u> + _____) Ton	\$ _____
2095.2	2,000	Ton	OHM - Disposal Of Soil - Daily Cover Unlined Landfill (Class B-1) <u>Twenty Seven</u> + _____ Dollars (\$ <u>27.00</u> + _____) Ton	\$ _____

Name of Bidder: _____

00300-5

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
2095.3	2,450	Ton	OHM - Disposal Of Soil - Daily Cover Lined Landfill (Class B-2) <u>Thirty +</u> _____ Dollars (\$ <u>30.00 +</u> _____) Ton	\$ _____
2095.4	1,450	Ton	OHM - Disposal Of Soil - Non-Hazardous Solid Waste Asphalt Batching (Class B-3) <u>Thirty Two +</u> _____ Dollars (\$ <u>32.00 +</u> _____) Ton	\$ _____
2095.5	50	Ton	OHM - Disposal Of Soil - Non-Hazardous Solid Waste Thermal Treatment (Class B-4) <u>Forty +</u> _____ Dollars (\$ <u>40.00 +</u> _____) Ton	\$ _____
2095.6	950	Ton	OHM - Disposal Of Soil - Non-Hazardous Solid Waste (Class B-5) <u>Forty Five +</u> _____ Dollars (\$ <u>45.00 +</u> _____) Ton	\$ _____
2095.7	500	Ton	OHM - Disposal Of Soil With Debris- Non-Hazardous Solid Waste (Class B-6) <u>Fifty Five +</u> _____ Dollars (\$ <u>55.00 +</u> _____) Ton	\$ _____
2095.8	500	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) <u>Seventy +</u> _____ Dollars (\$ <u>70.00 +</u> _____) Ton	\$ _____

Name of Bidder: _____

00300-6

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
2095.9	50	Ton	OHM - Disposal Of Soil - RCRA Hazardous Waste (Class C-2) <u>Eighty +</u> _____ Dollars (\$ <u>80.00 +</u> _____) Ton	\$ _____
2095.10	50	Ton	OHM - Disposal Of Special Waste <u>Eighty +</u> _____ Dollars (\$ <u>80.00 +</u> _____) Ton	\$ _____
2100.1	1	Lump Sum	Tree Protection And Maintenance <u>Ten Thousand +</u> _____ Dollars (\$ <u>10,000.00 +</u> _____) Lump Sum	\$ _____
2100.2	6	Each	Stump Removal _____ Dollars (\$ _____) Each	\$ _____
2140.1	30	Day	Treatment Of Construction Dewatering _____ Dollars (\$ _____) Day	\$ _____
2210.1	540	Cubic Yard	Test Pits <u>Ten +</u> _____ Dollars (\$ <u>10.00 +</u> _____) Cubic Yard	\$ _____
2210.2	40	Cubic Yard	Control Density Fill For Backfill <u>Twenty Five +</u> _____ Dollars (\$ <u>25.00 +</u> _____) Cubic Yard	\$ _____

Name of Bidder: _____

00300-7

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
2210.3	1,324	Cubic Yard	Gravel Borrow (Type b) _____ Dollars (\$ _____) Cubic Yard	\$ _____
2210.4	1,300	Cubic Yard	Unclassified Excavation _____ Dollars (\$ _____) Cubic Yard	\$ _____
2210.5	1,420	Cubic Yard	Roadway Earth Excavation _____ Dollars (\$ _____) Cubic Yard	\$ _____
2210.6	415	Cubic Yard	Excavation for SBSS for trees in pavement – to depth of 4.5 ft below finished grade _____ Dollars (\$ _____) Cubic Yard	\$ _____
2210.7	443	Cubic Yard	Excavation for Planting Beds – to depth of 3.5 ft below finished grade _____ Dollars (\$ _____) Cubic Yard	\$ _____
2252.1	2	Each	Type 1 Manhole Precast 4-Foot Diameter _____ Dollars (\$ _____) Each	\$ _____
2252.2	7	Each	Type 4 Manhole Precast 4-Foot Diameter _____ Dollars (\$ _____) Each	\$ _____

Name of Bidder: _____

00300-8

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
2252.3	2	Each	Type 1 Manhole Precast 6-Foot Diameter _____ Dollars (\$ _____) Each	\$ _____
2252.4	2	Each	Type-7 Manhole Precast 3'x4' _____ Dollars (\$ _____) Each	\$ _____
2252.5	10	Each	Existing Drainage or Sewer Structure Adjusted _____ Dollars (\$ _____) Each	\$ _____
2500.1	900	Ton	Temporary Hot Mix Asphalt (Trench Width and Temporary Ramps) _____ Dollars (\$ _____) Ton	\$ _____
2500.2	1,000	Ton	Hot Mix Asphalt Base Course – Full Width _____ Dollars (\$ _____) Ton	\$ _____
2500.3	700	Ton	Hot Mix Asphalt Intermediate Course – Full Width _____ Dollars (\$ _____) Ton	\$ _____
2500.4	900	Ton	Hot Mix Asphalt Top Course – Full Width _____ Dollars (\$ _____) Ton	\$ _____

Name of Bidder: _____

00300-9

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
2500.5	100	Ton	Hand Placed Hot Mix Asphalt _____ Dollars (\$ _____) Ton	\$ _____
2500.6	3,000	Square Yard	Cold Plane 2-Inch, Full Width _____ Dollars (\$ _____) Square Yard	\$ _____
2500.7	6,785	Square Yard	Fine Grading and Compacting _____ Dollars (\$ _____) Square Yard	\$ _____
2500.8	300	Linear Foot	Hot Poured Rubberized Asphalt Sealing _____ Dollars (\$ _____) Linear Foot	\$ _____
2500.9	280	Linear Foot	Hot Mix Asphalt Infrared Asphalt Sealing _____ Dollars (\$ _____) Linear Foot	\$ _____
2510.1	460	Square Yard	Hot Mix Asphalt Porous Paving _____ Dollars (\$ _____) Square Yard	\$ _____
2510.2	460	Cubic Yards	Porous Paving Trench Excavation _____ Dollars (\$ _____) Cubic Yards	\$ _____

Name of Bidder: _____

00300-10

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
2524.1	2,250	Square Yard	4-inch Cement Concrete Sidewalks _____ Dollars (\$ _____) Square Yard	\$ _____
2524.2	170	Square Yard	6-inch Cement Concrete Sidewalks At Driveways _____ Dollars (\$ _____) Square Yard	\$ _____
2524.3	930	Square Yard	6-inch Cement Concrete Sidewalks At Pedestrian Ramps And Intersections _____ Dollars (\$ _____) Square Yard	\$ _____
2524.4	155	Square Yard	6-inch Reinforced Concrete Driveway at Fire Station _____ Dollars (\$ _____) Square Yard	\$ _____
2524.5	25	Square Yard	Wire Cut Bricks On 4-inch Hot Mix Asphalt _____ Dollars (\$ _____) Square Yard	\$ _____
2524.6	925	Linear Foot	Remove and Reset/Relocate Granite Curb (Straight and Curved) _____ Dollars (\$ _____) Linear Foot	\$ _____
2524.7	2,400	Linear Foot	Remove and Discard Granite Curb (Straight and Curved) _____ Dollars (\$ _____) Linear Foot	\$ _____

Name of Bidder: _____

00300-11

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
2524.8	3,155	Linear Foot	New Granite Curb Type VA 4 (Straight and Curved) _____ Dollars (\$ _____) Linear Foot	\$ _____
2524.9	340	Linear Foot	New Granite Curb Type VA 4 Transition (Straight and Curved) _____ Dollars (\$ _____) Linear Foot	\$ _____
2524.10	40	Linear Foot	New Granite Curb Type VA 3 for Raised Crosswalks _____ Dollars (\$ _____) Linear Foot	\$ _____
2524.11	540	Linear Foot	New Beveled Curb (Straight and Curved) _____ Dollars (\$ _____) Linear Foot	\$ _____
2524.12	2	Each	Granite Curb Corner Type A _____ Dollars (\$ _____) Each	\$ _____
2524.13	870	Square Foot	Cast-in-place Detectible Tile _____ Dollars (\$ _____) Square Foot	\$ _____
2524.14	4	Square Yard	Scored Cement Concrete Pavement Island _____ Dollars (\$ _____) Square Yard	\$ _____

Name of Bidder: _____

00300-12

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
2524.15	3	Each	Removable False Curb Utility Cover _____ Dollars (\$ _____) Each	\$ _____
2577.1	5,400	Linear Foot	4-inch to 8-inch Reflectorized Pavement Markings - Yellow and White Thermoplastic _____ Dollars (\$ _____) Linear Foot	\$ _____
2577.2	80	Square Foot	Pavement Arrows and Legends Refl. White (Surface Applied Tape) _____ Dollars (\$ _____) Square Foot	\$ _____
2577.3	320	Square Foot	Pavement Arrows and Legends Refl. White (Thermoplastic) _____ Dollars (\$ _____) Square Foot	\$ _____
2577.4	2,600	Square Foot	Crosswalks and Stop Lines Refl. White (Thermoplastic) _____ Dollars (\$ _____) Square Foot	\$ _____
2577.5	4,400	Square Foot	High Friction Surface Treatment _____ Dollars (\$ _____) Square Foot	\$ _____
2577.6	15	Each	Bikes Yield to Peds Marking (Surface Applied Tape) _____ Dollars (\$ _____) Each	\$ _____

Name of Bidder: _____

00300-13

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
2577.7	1,100	Square Yard	High SRI Surface Paint _____ Dollars (\$ _____) Square Yard	\$ _____
2604.1	8	Each	Catch Basin - Type 1 Single Grate (4-ft Diameter) _____ Dollars (\$ _____) Each	\$ _____
2604.2	8	Each	Catch Basin - Type 5 Direct Inlet _____ Dollars (\$ _____) Each	\$ _____
2604.3	3	Each	Catch Basin - Type 3 Single Grate (3'x4') _____ Dollars (\$ _____) Each	\$ _____
2604.4	14	Each	Plaza Area Drain Inlet and Riser _____ Dollars (\$ _____) Each	\$ _____
2609.1	30	Linear Foot	Pipe - RCP (Gravity) 48-inch _____ Dollars (\$ _____) Linear Foot	\$ _____
2615.1	25	Linear Foot	Pipe - DI (Gravity) 10-inch _____ Dollars (\$ _____) Linear Foot	\$ _____

Name of Bidder: _____

00300-14

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
2615.2	275	Linear Foot	Pipe - DI (Gravity) 12-inch _____ Dollars (\$ _____) Linear Foot	\$ _____
2622.1	25	Linear Foot	Reconnect, Repair or Relocate Existing Sanitary Sewer and Storm Drain Laterals _____ Dollars (\$ _____) Linear Foot	\$ _____
2622.2	560	Linear Foot	Pipe - PVC (Gravity) 6-inch Perforated _____ Dollars (\$ _____) Linear Foot	\$ _____
2622.3	260	Linear Foot	Pipe - PVC (Gravity) 6-inch _____ Dollars (\$ _____) Linear Foot	\$ _____
2622.4	25	Linear Foot	Pipe - PVC (Gravity) 8-inch _____ Dollars (\$ _____) Linear Foot	\$ _____
2622.5	25	Linear Foot	Pipe - PVC (Gravity) 10-inch _____ Dollars (\$ _____) Linear Foot	\$ _____
2622.6	245	Linear Foot	Pipe - PVC (Gravity) 12-inch _____ Dollars (\$ _____) Linear Foot	\$ _____

Name of Bidder: _____

00300-15

Item #	Estimated Quantity	Units	<u>ITEM DESCRIPTION</u> Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2622.7	30	Linear Foot	Pipe - PVC (Gravity) 18-inch _____ Dollars (\$ _____) Linear Foot	\$ _____
2630.1	15	Linear Foot	Pipe - DI (Water) 4-inch _____ Dollars (\$ _____) Linear Foot	\$ _____
2630.2	105	Linear Foot	Pipe - DI (Water) 6-inch _____ Dollars (\$ _____) Linear Foot	\$ _____
2630.3	740	Linear Foot	Pipe - DI (Water) 8-inch _____ Dollars (\$ _____) Linear Foot	\$ _____
2630.4	12	Linear Foot	Pipe - DI (Water) 12-inch _____ Dollars (\$ _____) Linear Foot	\$ _____
2640.1	2	Each	4-inch Gate Valve and Gate Box _____ Dollars (\$ _____) Each	\$ _____
2640.2	7	Each	6-inch Gate Valve and Gate Box _____ Dollars (\$ _____) Each	\$ _____

Name of Bidder: _____

00300-16

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
2640.3	8	Each	8-inch Gate Valve and Gate Box _____ Dollars (\$ _____) Each	\$ _____
2640.4	2	Each	12-inch Gate Valve and Gate Box _____ Dollars (\$ _____) Each	\$ _____
2640.5	5	Each	Remove and Replace Water Curb Box _____ Dollars (\$ _____) Each	\$ _____
2640.6	5	Each	Existing Water Valve Box Structure Adjusted _____ Dollars (\$ _____) Each	\$ _____
2645.1	7	Each	New Hydrant _____ Dollars (\$ _____) Each	\$ _____
2645.2	4	Each	Remove and Dispose of Existing Hydrant _____ Dollars (\$ _____) Each	\$ _____
2660.1	350	Linear Foot	1-inch to 3-inch Water Service Replacement _____ Dollars (\$ _____) Linear Foot	\$ _____

Name of Bidder: _____

00300-17

Item #	Estimated Quantity	Units	<u>ITEM DESCRIPTION</u> Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2780.1	485	Square Yards	Concrete Unit Pavers _____ Dollars (\$ _____) Square Yards	
2780.2	116	Square Yards	Permeable Concrete Unit Pavers _____ Dollars (\$ _____) Square Yards	
2810.1	1	Lump Sum	Irrigation System _____ Dollars (\$ _____) Lump Sum	\$ _____
2890.1	1	Lump Sum	Traffic Signal Reconstruction – Location 1 Inman Square _____ Dollars (\$ _____) Lump Sum	\$ _____
2890.2	1,400	Linear Foot	3" Electrical Conduit Type NM - Plastic (UL) _____ Dollars (\$ _____) Linear Foot	\$ _____
2890.3	50	Linear Foot	4" Electrical Conduit Type NM - Plastic (UL) _____ Dollars (\$ _____) Linear Foot	\$ _____
2890.4	6	Each	Pull Box 12" x 12" _____ Dollars (\$ _____) Each	\$ _____

Name of Bidder: _____

00300-18

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
2890.5	12	Each	Pull Box 24" x 12" _____ Dollars (\$ _____) Each	\$ _____
2890.6	1	Each	Service Connection Eversource Approved Handhole _____ Dollars (\$ _____) Each	\$ _____
2900.1	1	Lump Sum	Planting Areas _____ Dollars (\$ _____) Lump Sum	\$ _____
2901.1	276	Cubic Yards	Sand Based Structural Soil _____ Dollars (\$ _____) Cubic Yards	\$ _____
2901.2	127	Cubic Yards	Planting Soil _____ Dollars (\$ _____) Cubic Yards	\$ _____
2901.3	190	Cubic Yards	Horticulture Subsoil _____ Dollars (\$ _____) Cubic Yards	\$ _____
2950.1	50	Square Yard	Hardscape Back of Sidewalk Restoration _____ Dollars (\$ _____) Square Yard	\$ _____

Name of Bidder: _____

00300-19

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
2950.2	100	Square Yard	Asphalt Back of Sidewalk Restoration _____ Dollars (\$ _____) Square Yard	\$ _____
2950.3	50	Square Yard	Landscape Back of Sidewalk Restoration _____ Dollars (\$ _____) Square Yard	\$ _____
2980.1	300	Square Foot	Warning- Regulatory and Route Marker - Aluminum Panel (Type A) _____ Dollars (\$ _____) Square Foot	\$ _____
2980.2	12	Each	Street Name Sign _____ Dollars (\$ _____) Each	\$ _____
2980.3	75	Each	Steel Sign Post _____ Dollars (\$ _____) Each	\$ _____
2980.4	10	Each	Parking Meter Post _____ Dollars (\$ _____) Each	\$ _____
2980.5	4	Each	Bus Shelter _____ Dollars (\$ _____) Each	\$ _____

Name of Bidder: _____

00300-20

Item #	Estimated Quantity	Units	<u>ITEM DESCRIPTION</u> Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2980.6	1	Each	Plaza Memorial Sign _____ Dollars (\$ _____) Each	\$ _____
2990.1	6	Each	Steel Bench _____ Dollars (\$ _____) Each	\$ _____
2990.2	90	Linear Feet	6' Wood Lattice Fence and Gate _____ Dollars (\$ _____) Linear Feet	\$ _____
2990.3	39	Each	Bike Ring (City Standard) _____ Dollars (\$ _____) Each	\$ _____
2990.4	5	Each	Bike Rack (Parabolic) _____ Dollars (\$ _____) Each	\$ _____
2990.5	6	Each	Solar Trash/Recycling Receptacle _____ Dollars (\$ _____) Each	\$ _____
2990.6	6	Each	Trash Receptacle – City Standard _____ Dollars (\$ _____) Each	\$ _____

Name of Bidder: _____

00300-21

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
2990.7	1	Lump Sum	Custom Wood Slat Bench Top; Metal frame, Armrests, and Perforated Backs _____ Dollars (\$ _____) Lump Sum	\$ _____
2990.8	1	Lump Sum	Public Art Concrete Footing _____ Dollars (\$ _____) Lump Sum	\$ _____
2990.81	1	Lump Sum	Public Art Installation Assistance _____ Dollars (\$ _____) Lump Sum	\$ _____
2990.9	1	Lump Sum	Transport and Reset Monument of Mayor Vellucci _____ Dollars (\$ _____) Lump Sum	\$ _____
2990.11	9	Each	Metal Table – with Perforated Chess Board Top (Moveable) _____ Dollars (\$ _____) Each	\$ _____
2990.12	18	Each	Metal Table – with Armrests (Moveable) _____ Dollars (\$ _____) Each	\$ _____
2990.13	18	Each	Metal Table – without Armrests (Moveable) _____ Dollars (\$ _____) Each	\$ _____

Name of Bidder: _____

00300-22

Item #	Estimated Quantity	Units	<u>ITEM DESCRIPTION</u> Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
2990.14	1	Each	Community Bulletin Board _____ Dollars (\$ _____) Each	\$ _____
2990.15	59	Linear Feet	Weathered Steel Landscape Curb _____ Dollars (\$ _____) Linear Feet	\$ _____
2995.1	1	Lump Sum	Granite Bench Base _____ Dollars (\$ _____) Lump Sum	\$ _____
2995.2	1	Lump Sum	Granite Vellucci Monument Base _____ Dollars (\$ _____) Lump Sum	\$ _____
2995.3	1	Lump Sum	Granite Vellucci Plaza Wall _____ Dollars (\$ _____) Lump Sum	\$ _____
2995.4	1	Lump Sum	Granite Landscape Curb & Planter Walls _____ Dollars (\$ _____) Lump Sum	\$ _____
3300.1	4	Each	CIP Concrete Pipe Connection 15-Inch Through 48-Inch (CIP Field Closures) _____ Dollars (\$ _____) Each	\$ _____

Name of Bidder: _____

00300-23

Item #	Estimated Quantity	Units	<p style="text-align: center;"><u>ITEM DESCRIPTION</u></p> <p style="text-align: center;">Description of the Work and Unit Price Bid Written in Words and Numbers</p>	Amount
3300.2	1	Lump Sum	Springfield Street Parking Lot Concrete Ramp _____ Dollars (\$ _____) Lump Sum	\$ _____
16135.1	150	Linear Foot	1-Inch Electrical Conduit (Single) Concrete Encased (Lighting) _____ Dollars (\$ _____) Linear Foot	\$ _____
16135.2	800	Linear Foot	2-Inch Electrical Conduit (Single) Concrete Encased (Lighting) _____ Dollars (\$ _____) Linear Foot	\$ _____
16135.3	650	Linear Foot	3-Inch Electrical Conduit (Single) Concrete Encased (Lighting) _____ Dollars (\$ _____) Linear Foot	\$ _____
16135.4	25	Each	Electrical Handhole (Lighting) - Municipal Standard _____ Dollars (\$ _____) Each	\$ _____
16135.5	34	Each	Light Standard Foundation (Standard Precast) _____ Dollars (\$ _____) Each	\$ _____
16135.6	25	Each	Ground Rod 8-Ft Long _____ Dollars (\$ _____) Each	\$ _____

Name of Bidder: _____

00300-24

Item #	Estimated Quantity	Units	<u>ITEM DESCRIPTION</u> Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
16135.7	2	Each	Acorn Luminaire and Pole _____ Dollars (\$ _____) Each	\$ _____
16135.8	13	Each	Pendant Luminaire and Pole (1 and 2 Head) _____ Dollars (\$ _____) Each	\$ _____
16135.9	6	Each	Contemporary Luminaire and Pole _____ Dollars (\$ _____) Each	\$ _____
16135.10	5	Each	Steel Pole w/ GFI Receptacle _____ Dollars (\$ _____) Each	\$ _____
16135.11	24	Each	Remove and Stack Existing Street Light _____ Dollars (\$ _____) Each	\$ _____
16135.12	2	Each	Remove and Relocate Existing Street Light _____ Dollars (\$ _____) Each	\$ _____
16135.13	1,800	Linear Foot	Wire Type 7 No. 10 General Purpose _____ Dollars (\$ _____) Linear Foot	\$ _____

Name of Bidder: _____

00300-25

Item #	Estimated Quantity	Units	<u>ITEM DESCRIPTION</u> Description of the Work and Unit Price Bid Written in Words and Numbers	Amount
16135.14	2,400	Linear Foot	Wire Type 7 No. 4 General Purpose _____ Dollars (\$ _____) Linear Foot	\$ _____
16135.15	800	Linear Foot	Wire Type 7 No. 6 Grounding and Bonding _____ Dollars (\$ _____) Linear Foot	\$ _____
16135.16	800	Linear Foot	Wire Type 7 No. 10 General Purpose _____ Dollars (\$ _____) Linear Foot	\$ _____
16135.17	2	Each	Lighting Control Equipment _____ Dollars (\$ _____) Each	\$ _____
16135.18	6	Each	Steel Pole _____ Dollars (\$ _____) Each	\$ _____
16135.19	180	Linear Foot	Festoon String Lighting _____ Dollars (\$ _____) Linear Foot	\$ _____

Name of Bidder: _____

00300-26

Grand Total Amount of Bid:

\$ _____
(Amount in Figures)

(Amount in Words)

Also write the amount of the Bid, in words and numbers, in the spaces provided on page 300-2.

Name of Bidder: _____

00300-27

- H. The undersigned agrees if selected as General Contractor, within seven 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 as **Additional Insured**, complying with the Insurance requirements set forth herein in the General Terms and Conditions of the contract, Article 8.

The City of Cambridge further requires that the General Contractor furnish the City with a copy of all insurance policies prior to or with the delivery of its signed Contract to the City.

- I. Bidder understands that the Owner reserves the right to reject any or all bids and to waive any minor informalities in the bidding prices.
- J. Total bid amounts are to be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.
- K. The bidder hereby certifies it shall comply with the minority workforce ratios and specific action contained in the Cambridge Employment Plan, the Supplemental Equal Employment Opportunity Program 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.
- L. The bidder agrees that this bid shall be good and may not be withdrawn for a period of 90 days after the scheduled closing time for receiving bids.
- M. 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.
- N. 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.

Name of Bidder: _____

00300-28

O. 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.

"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".

P. 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 _____

(Name of General Bidder)

By _____
(Name of Person Signing Bid and Title)

(Print Name of Person Signing Bid and Title)

(Business Address)

(City and State)

(Contact Phone Number)

(Contact Email)

Name of Bidder: _____

00300-29

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.

The condition of the above obligation is such that the Principal has submitted to the City of Cambridge, Massachusetts, a certain Bid attached hereto and hereby made a part hereof for the Project described as Inman Square Intersection Safety Improvement 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 them.

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 set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and have caused this bond to be signed by their proper officers on this _____ day of _____ 20__.

CONTRACTOR AS PRINCIPAL

SURETY

(Signature)

(Signature)

Name and Title:

Name and Title:

SEAL

SEAL

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 Supplier Diversity Office (SDO), Certified Minority/Women Business Directory. Only MBE firms approved by SDO 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 SDO 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 SDO-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.
6. During the bid period if you have any questions please email them to purchasing@cambridgema.gov. After the bid opening date, if you have any questions about the above steps, please call Betsy M. Allen, Director of Equity and Inclusion, at (617) 349-4331

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 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 previously given by SDO. 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 sub contract 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 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 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.

CONTRACTOR CERTIFICATION OF COMPLIANCE
Minority Business Enterprise Requirements

FORM
1
M.B.E.

Name & Address of Participating Minority Bus. Enterprises	Name of Participant	Dollar Value of Participation
--	---------------------	-------------------------------

1.

2.

3.

4.

5.

6.

7. GRAND TOTAL FOR MINORITY BUSINESS COMMITMENT \$ _____

8. PERCENTAGE MBE PARTICIPATION (Line 7 Divided by tot. 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

**FORM
LETTER OF INTENT TO PARTICIPATE
Minority Business Enterprise Requirements**

2
M.B.E.

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 Supplier Diversity Office (SDO), as a Minority Business Enterprise and is listed as such in the most recently issued SDO 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 SDO. I further certify that my company will give immediate notification in writing to both SDO 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*	QUANTIT Y	UNIT PRICE	AMOUNT

TOTAL AMOUNT\$ _____

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

Date

MBE Contractor

MBE Authorized Signature

Business Address

**FORM
CONTRACTOR REQUEST FOR EXTENSION
Minority Business Enterprise Requirements**

3
M.B.E.

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 **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 SDO MINORITY/WOMEN BUSINESS DIRECTORY supplied by the City of Cambridge Purchasing Department with the Bidding Documents; that said contracts 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. _____ | 11. _____ |
| 2. _____ | 12. _____ |
| 3. _____ | 13. _____ |
| 4. _____ | 14. _____ |
| 5. _____ | 15. _____ |
| 6. _____ | 16. _____ |
| 7. _____ | 17. _____ |
| 8. _____ | 18. _____ |
| 9. _____ | 19. _____ |
| 10. _____ | 20. _____ |

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 and opportunity to secure the required percentage of Minority Business participation.

Date

General Contractor

Authorized Signature

Business Address

INFORMATION ON UNSUCCESSFUL MBE CONTACT
Minority Business Enterprise Requirements

FORM

4
M.B.E.

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

ITEM NO. ON REQUEST-FOR-EXTENSION _____

NAME OF MBE COMPANY CONTACTED _____

ADDRESS OF " " _____

TELEPHONE NO. " " _____

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 COMPANY 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

NOTARIZED STATEMENT OF BIDDER'S QUALIFICATIONS

All questions must be answered and the data given must be clear and comprehensive. **This statement must be notarized.** If necessary, questions may be answered on separate attached sheets. **For Items No. 9 and 10. of this Section "Qualification Requirements", the Bidder must provide all information requested and submit this information on the sheets provided here.**

The Bidder may submit any additional information it desires.

1. The names, titles, and 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.

4. How many years have you been engaged in the **construction of drainage, water distribution systems, and roadway and sidewalk** business under your present firm or trade name?

5. What is the general nature of work normally performed by your company?

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

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

8. 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:

8A Qualification Requirement for Reconstruction of Storm Drains and Water Mains 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 and storm drains, within a crowded urban setting with heavy volumes of motor vehicle, bicycle and pedestrian traffic that required coordination and rerouting of traffic and transportation with MBTA, and with city police, fire, and traffic departments. The dollar value of each project must have been at least \$2,000,000.

Project #8A-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 #8A-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 #8A-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:

8B 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, line striping, surface improvements, traffic and pedestrian signals, and landscaping. The dollar value of each project must have been at least \$4,000,000.

Project #8B-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 #8B-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 #8B-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:

8C 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, attendance at community meetings, and compliance with OSHA construction standards. The dollar value of each project must have been at least \$4,000,000.

Project #8C-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 #8C-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 #8C-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:

8D 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 city police, fire, parking, traffic and handicap compliance departments. The dollar value of each project must have been at least \$4,000,000.

Project #8D-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 #8D-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 #8D-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:

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

Project #9-1:

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 performed as contractor or sub-contractor?: _____

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

10. Does your firm have the 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?

11. 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 2019-2020. Rank the list according to decreasing dollar value of work to be done in Years 2019-2020. 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 project, dollar value of work, and the estimated completion date. Under Project No. 11 in the following TABLE, indicate the number of projects and the sum of the dollar value of work that you expect to perform in Years 2019-2020 for all the remaining projects in the list.

BIDDER PROJECTED WORK LOAD

Project #	Name and Type of Project	Project Owner	Dollar Value of Work to be completed in 2019-2020	Estimated Project Completion Date
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11	Total Remaining Projects:		Total Value of Remaining Projects:	

12. 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

13. Background and experience of the principal member of your organization, including the officers.

.....

.....

.....

.....

.....

14. Who will be the contractor's on site project manager? State such person's qualifications. Also list names of employees who will be participating in this contract and their qualifications (years of experience, etc.).

13. Who will be the contractor's full time on-site superintendent? Submit such person's resume for review by Owner/Engineer. The Project Superintendent must have a minimum of 10 years construction experience; demonstrate ability to manage a budget, schedule, and crew coordination; demonstrate experience in traffic management in heavily traveled streets, community relations with local businesses and residents, utility coordination, contaminated soil management, and permit compliance. Also list names of employees who will be participating in this contract and their qualifications (years of experience, etc.).

15. 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

16. Federal Identification Number and Dun and Bradstreet Number

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

Name _____

Signature _____

Title _____

18. 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 _____)

as:

_____, being duly sworn,

deposes and says that he 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 _____,
20_____

(Notary Public)

My commission expires _____, 20____

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

_____ certifies that:
(General Contractor)

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.

Signed under the penalties of perjury:

Signature of authorized representative of contractor

Print name of authorized representative of contractor

Dated: _____

THIS FORM MUST BE SUBMITTED WITH YOUR BID

PROJECTED WORKFORCE CERTIFICATION

I, _____,
(General Contractor)

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

Inman Square Intersection Safety Improvement Project

GENERAL CONTRACTOR

ESTIMATED # OF NEW HIRES

SUBTRADE

ESTIMATED # OF NEW HIRES

Signed under penalties of perjury. _____

**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 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 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

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 subbidders 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 apprenticeship 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

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 SUB-BIDS OVER \$25,000 INCLUDING ALL ALTERNATES, IF ANY.

RETURN THIS FORM WITH YOUR BID

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.

**Americans With Disabilities Act (42 U.S.C. 12131)
Section 504 of the Rehabilitation Act of 1973
Tax Compliance/Anti-Collusion Statement
Debarment Statement**

The Americans with Disabilities Act (the "Act") applies to all employers of fifteen or more employees. All vendors 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 record of such impairment; and discrimination against an individual regarded - even if inaccurately - as having such an impairment. The Act also expressly prohibits discrimination that is based on an individual's relationship or association with a disabled person.

The Contractor 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 Contractor's services, the individual with the disability must meet the essential eligibility requirements for receipt of the Contractor's services or participation in the Contractor's programs or activities with or without: 1) reasonable modifications to the Contractor's rules, policies and practices; 2) removal of architectural, communication, or transportation barriers; or, 3) provisions of auxiliary aids and services.

By submitting its contract, the Contractor 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 Contractor is receiving federal funds.

The undersigned certifies under penalties of perjury that this contract 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, business, partnership, corporation, union, committee, club, or other organization, entity, or group of individuals

As required by M.G.L. c. 62C, §49A, the undersigned certifies under the penalties of perjury that the Contractor has complied with all laws of the commonwealth relating to taxes, reporting of employees and contractors, and withholding and remitting child support.

The undersigned certifies that it is not currently subject to any State or Federal debarment order.

Date: _____

(Print Name of person signing bid)

(Signature & Title)

This form must be submitted 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

SRF Project No. :

Contract No. :

Contract Title :

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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WAGE THEFT PREVENTION CERTIFICATION

In Executive Order 2016-1, the City of Cambridge established requirements for City contracts in an effort to prevent wage theft. Prospective vendors must provide the following certifications or disclosures with their bids/proposals. Failure to provide the following shall result in rejection of the bid/proposal.

Instructions for this form:

A prospective vendor must check box 1 or box 2, as applicable, as well as boxes 3-5, and must sign this Form, certifying compliance with the requirements set out in this Form. This Form must be included with the bid or proposal, and for multi-year contracts must be completed annually on the contract anniversary and filed with the Purchasing Agent.

The undersigned certifies under the pains and penalties of perjury that the vendor is in compliance with the provisions of Executive Order 2016-1 as currently in effect.

All vendors must certify that [check either box 1 or box 2, as applicable]:

1. Neither this firm nor any prospective subcontractor has been subject to a federal or state criminal or civil judgment, administrative citation, final administrative determination, order or debarment resulting from a violation of G.L. c. 149, G.L. c. 151, or 29 U.S.C. 201 *et seq.* within three (3) years prior to the date of this bid/proposal submission.

OR

2. This firm, or a prospective subcontractor of this firm, has been subject to a federal or state criminal or civil judgment, administrative citation, final administrative determination, order or debarment resulting from a violation of G.L. c. 149, G.L. c. 151, or 29 U.S.C. 201 *et seq.* within three (3) years prior to the date of this bid/proposal submission and such documentation is included in the bid/proposal submission.

In addition, all vendors must certify each of the following:

3. Any federal or state criminal or civil judgment, administrative citation, final administrative determination, order or debarment resulting from a violation of G.L. c. 149, G.L. c. 151, or 29 U.S.C. 201 *et seq.* imposed on this firm or on any prospective subcontractor while any bid/proposal to the City is pending and, if awarded a contract, during the

term of the contract, will be reported to the Purchasing Agent or other City department within five (5) days of receiving notice.

4. Vendors awarded a contract that have disclosed a federal or state criminal or civil judgment, administrative citation, final administrative determination, or order resulting from a violation of G.L. c. 149, G.L. c. 151, or 29 U.S.C. 201 *et seq.* within three (3) years prior to the date of this bid/proposal, while the bid/proposal was pending, or during the term of the contract shall, upon request, furnish their monthly certified payrolls for their City contract to the Purchasing Agent for all employees working on such contract and are required to obtain a wage bond or other suitable insurance in an amount equal to the aggregate of one year's gross wages for all employees. Vendors subject to a state or federal debarment for violation of the above laws or prohibited from contracting with the Commonwealth are prohibited from contracting with the City, and upon a finding or order of debarment or prohibition, the City may terminate the contract.

5. Notice provided by the City, informing employees of the protections of Executive Order 2016-1 and applicable local, state, and federal law will be posted by this firm in conspicuous places.

Attested hereto under the pains and penalties of perjury:

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

Signature

(Name of Business)

Pursuant to Executive Order 2016-1, vendors who have been awarded a contract with the City of Cambridge must post the Massachusetts Wage and Hour Laws notice informing employees of the protections of G.L. c. 149, G.L. c. 151, and 21 U.S.C. 201 *et seq.* in conspicuous places. This notice can be found at <http://www.mass.gov/ago/docs/workplace/wage/wagehourposter.pdf>

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:

Inman Square Intersection Safety Improvement Project

CONTRACT TIME

The Contract Time shall be for Five Hundred Thirty Four (534) calendar days on or before seven (7) days following the date set forth in the Notice to Proceed. The City reserves the right to extend the contract for a set period should the City determine such extension is in the best interest of the City.

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.

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 the amount certified 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 five thousand three hundred sixty dollars and 00/00 (\$5,360.00) 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

Louis DePasquale, City Manager

Signature

Elizabeth Unger, Purchasing Agent

APPROVED AS TO FORM:

BY: _____
Print Name and Title

Nancy E. Glowa, City Solicitor

(Corporate Seal)

APPROVED AS TO THE AVAILABILITY
OF APPROPRIATION OF FUNDS:

Budget Code: _____

James Monagle, City Auditor

PERFORMANCE BOND

We, the undersigned,

(Name of Contractor)

(Address of Contractor)

hereinafter called Principal, and

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto 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 **Inman Square Intersection Safety Improvement 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 from 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 expenses 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 there under of the specifications accompanying the same shall in any wise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work

or to the specifications. Provided, further, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed on this

_____ day of _____, 20_____.

CONTRACTOR
AS PRINCIPAL

SURETY

(signature)

Name and Title:

(signature)

Name and Title:

SEAL

SEAL

Payment Bond

We, the undersigned,

(Name of Contractor)

(Address of Contractor)

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

(Name of Surety)

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto 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 **Inman Square Intersection Safety Improvement 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 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 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 wise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specifications.

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

IN WITNESS WHEREOF, this instrument is executed on this ____ day of _____ 20

CONTRACTOR AS PRINCIPAL

SURETY

(Signature)

(Signature)

Name and Title:

Name and Title:

SEAL

SEAL

Certificate of Authority

This document hereby certifies that, _____, the _____ of this Corporation _____, is hereby authorized and empowered to make, enter into, sign, seal , and deliver on behalf of the Corporation, a contract for **Inman Square Intersection Safety Improvement Project** with the City of Cambridge.

This authority is given by, _____, on _____ 20 _____.
(Print Name)

Attested by:

Signature: _____

Title: _____



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

Prevailing Wage Rates

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

CHARLES D. BAKER
Governor

ROSALIN ACOSTA
Secretary

KARYN E. POLITO
Lt. Governor

WILLIAM D MCKINNEY
Director

Awarding Authority: City of Cambridge Purchasing Department

Contract Number: 8514

City/Town: CAMBRIDGE

Description of Work: Inman Square Intersection Safety Improvements

Job Location: Inman Square intersection

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

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

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

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. <i>HEAT & FROST INSULATORS LOCAL 6 (BOSTON)</i>	12/01/2018	\$35.40	\$12.50	\$8.50	\$0.00	\$56.40
	06/01/2019	\$36.40	\$12.50	\$8.50	\$0.00	\$57.40
	12/01/2019	\$37.40	\$12.50	\$8.50	\$0.00	\$58.40
	06/01/2020	\$38.40	\$12.50	\$8.50	\$0.00	\$59.40
	12/01/2020	\$39.40	\$12.50	\$8.50	\$0.00	\$60.40
ASPHALT RAKER <i>LABORERS - ZONE 1</i>	12/01/2018	\$38.90	\$7.85	\$15.35	\$0.00	\$62.10
	06/01/2019	\$39.90	\$7.85	\$15.35	\$0.00	\$63.10
	12/01/2019	\$40.90	\$7.85	\$15.35	\$0.00	\$64.10
	06/01/2020	\$41.89	\$7.85	\$15.35	\$0.00	\$65.09
	12/01/2020	\$42.87	\$7.85	\$15.35	\$0.00	\$66.07
	06/01/2021	\$43.89	\$7.85	\$15.35	\$0.00	\$67.09
	12/01/2021	\$44.90	\$7.85	\$15.35	\$0.00	\$68.10
For apprentice rates see "Apprentice- LABORER"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$47.58	\$11.50	\$15.60	\$0.00	\$74.68
	06/01/2019	\$48.68	\$11.50	\$15.60	\$0.00	\$75.78
	12/01/2019	\$49.83	\$11.50	\$15.60	\$0.00	\$76.93
	06/01/2020	\$50.93	\$11.50	\$15.60	\$0.00	\$78.03
	12/01/2020	\$52.08	\$11.50	\$15.60	\$0.00	\$79.18
	06/01/2021	\$53.18	\$11.50	\$15.60	\$0.00	\$80.28
	12/01/2021	\$54.33	\$11.50	\$15.60	\$0.00	\$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BACKHOE/FRONT-END LOADER <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$47.58	\$11.50	\$15.60	\$0.00	\$74.68
	06/01/2019	\$48.68	\$11.50	\$15.60	\$0.00	\$75.78
	12/01/2019	\$49.83	\$11.50	\$15.60	\$0.00	\$76.93
	06/01/2020	\$50.93	\$11.50	\$15.60	\$0.00	\$78.03
	12/01/2020	\$52.08	\$11.50	\$15.60	\$0.00	\$79.18
	06/01/2021	\$53.18	\$11.50	\$15.60	\$0.00	\$80.28
	12/01/2021	\$54.33	\$11.50	\$15.60	\$0.00	\$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER <i>LABORERS - ZONE 1</i>	12/01/2018	\$38.90	\$7.85	\$15.35	\$0.00	\$62.10
	06/01/2019	\$39.90	\$7.85	\$15.35	\$0.00	\$63.10
	12/01/2019	\$40.90	\$7.85	\$15.35	\$0.00	\$64.10
	06/01/2020	\$41.89	\$7.85	\$15.35	\$0.00	\$65.09
	12/01/2020	\$42.87	\$7.85	\$15.35	\$0.00	\$66.07
	06/01/2021	\$43.89	\$7.85	\$15.35	\$0.00	\$67.09
	12/01/2021	\$44.90	\$7.85	\$15.35	\$0.00	\$68.10
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER <i>LABORERS - ZONE 1</i>	12/01/2018	\$39.40	\$7.85	\$15.35	\$0.00	\$62.60
	06/01/2019	\$40.40	\$7.85	\$15.35	\$0.00	\$63.60
	12/01/2019	\$41.40	\$7.85	\$15.35	\$0.00	\$64.60
	06/01/2020	\$42.39	\$7.85	\$15.35	\$0.00	\$65.59
	12/01/2020	\$43.37	\$7.85	\$15.35	\$0.00	\$66.57
	06/01/2021	\$44.39	\$7.85	\$15.35	\$0.00	\$67.59
	12/01/2021	\$45.40	\$7.85	\$15.35	\$0.00	\$68.60
For apprentice rates see "Apprentice- LABORER"						

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

Apprentice - BOILERMAKER - Local 29

Effective Date - 01/01/2019

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

Effective Date - 01/01/2020

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

Notes:

Apprentice to Journeyworker Ratio:1:4

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

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

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

Effective Date - 02/01/2019

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

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$27.45	\$10.75	\$20.80	\$0.00	\$59.00
2	60	\$32.94	\$10.75	\$20.80	\$0.00	\$64.49
3	70	\$38.43	\$10.75	\$20.80	\$0.00	\$69.98
4	80	\$43.92	\$10.75	\$20.80	\$0.00	\$75.47
5	90	\$49.41	\$10.75	\$20.80	\$0.00	\$80.96

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER	12/01/2018	\$47.10	\$11.50	\$15.60	\$0.00	\$74.20
<i>OPERATING ENGINEERS LOCAL 4</i>	06/01/2019	\$48.19	\$11.50	\$15.60	\$0.00	\$75.29
	12/01/2019	\$49.33	\$11.50	\$15.60	\$0.00	\$76.43
	06/01/2020	\$50.41	\$11.50	\$15.60	\$0.00	\$77.51
	12/01/2020	\$51.55	\$11.50	\$15.60	\$0.00	\$78.65
	06/01/2021	\$52.64	\$11.50	\$15.60	\$0.00	\$79.74
	12/01/2021	\$53.78	\$11.50	\$15.60	\$0.00	\$80.88

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

CAISSON & UNDERPINNING BOTTOM MAN	12/01/2018	\$39.75	\$7.85	\$15.55	\$0.00	\$63.15
<i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2019	\$40.75	\$7.85	\$15.55	\$0.00	\$64.15
	12/01/2019	\$41.75	\$7.85	\$15.55	\$0.00	\$65.15
	06/01/2020	\$42.74	\$7.85	\$15.55	\$0.00	\$66.14
	12/01/2020	\$43.72	\$7.85	\$15.55	\$0.00	\$67.12
	06/01/2021	\$44.74	\$7.85	\$15.55	\$0.00	\$68.14
	12/01/2021	\$45.75	\$7.85	\$15.55	\$0.00	\$69.15

For apprentice rates see "Apprentice- LABORER"

CAISSON & UNDERPINNING LABORER	12/01/2018	\$38.60	\$7.85	\$15.55	\$0.00	\$62.00
<i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2019	\$39.60	\$7.85	\$15.55	\$0.00	\$63.00
	12/01/2019	\$40.60	\$7.85	\$15.55	\$0.00	\$64.00
	06/01/2020	\$41.59	\$7.85	\$15.55	\$0.00	\$64.99
	12/01/2020	\$42.57	\$7.85	\$15.55	\$0.00	\$65.97
	06/01/2021	\$43.59	\$7.85	\$15.55	\$0.00	\$66.99
	12/01/2021	\$44.60	\$7.85	\$15.55	\$0.00	\$68.00

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CAISSON & UNDERPINNING TOP MAN <i>LABORERS - FOUNDATION AND MARINE</i>	12/01/2018	\$38.60	\$7.85	\$15.55	\$0.00	\$62.00
	06/01/2019	\$39.60	\$7.85	\$15.55	\$0.00	\$63.00
	12/01/2019	\$40.60	\$7.85	\$15.55	\$0.00	\$64.00
	06/01/2020	\$41.59	\$7.85	\$15.55	\$0.00	\$64.99
	12/01/2020	\$42.57	\$7.85	\$15.55	\$0.00	\$65.97
	06/01/2021	\$43.59	\$7.85	\$15.55	\$0.00	\$66.99
	12/01/2021	\$44.60	\$7.85	\$15.55	\$0.00	\$68.00
For apprentice rates see "Apprentice- LABORER"						
CARBIDE CORE DRILL OPERATOR <i>LABORERS - ZONE 1</i>	12/01/2018	\$38.90	\$7.85	\$15.35	\$0.00	\$62.10
	06/01/2019	\$39.90	\$7.85	\$15.35	\$0.00	\$63.10
	12/01/2019	\$40.90	\$7.85	\$15.35	\$0.00	\$64.10
	06/01/2020	\$41.89	\$7.85	\$15.35	\$0.00	\$65.09
	12/01/2020	\$42.87	\$7.85	\$15.35	\$0.00	\$66.07
	06/01/2021	\$43.89	\$7.85	\$15.35	\$0.00	\$67.09
	12/01/2021	\$44.90	\$7.85	\$15.35	\$0.00	\$68.10
For apprentice rates see "Apprentice- LABORER"						
CARPENTER <i>CARPENTERS -ZONE 1 (Metro Boston)</i>	03/01/2019	\$49.84	\$9.90	\$17.50	\$0.00	\$77.24

Apprentice - CARPENTER - Zone 1 Metro Boston

Effective Date - 03/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$24.92	\$9.90	\$1.73	\$0.00	\$36.55
2	60	\$29.90	\$9.90	\$1.73	\$0.00	\$41.53
3	70	\$34.89	\$9.90	\$12.31	\$0.00	\$57.10
4	75	\$37.38	\$9.90	\$12.31	\$0.00	\$59.59
5	80	\$39.87	\$9.90	\$14.04	\$0.00	\$63.81
6	80	\$39.87	\$9.90	\$14.04	\$0.00	\$63.81
7	90	\$44.86	\$9.90	\$15.77	\$0.00	\$70.53
8	90	\$44.86	\$9.90	\$15.77	\$0.00	\$70.53

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80
Step 1&2 \$34.06/ 3&4 \$40.71/ 5&6 \$58.83/ 7&8 \$65.54

Apprentice to Journeyworker Ratio:1:5

CARPENTER WOOD FRAME <i>CARPENTERS -ZONE 1 (Wood Frame)</i>	04/01/2019	\$32.49	\$7.07	\$7.86	\$0.00	\$47.42
	10/01/2019	\$32.97	\$7.07	\$7.86	\$0.00	\$47.90

All Aspects of New Wood Frame Work

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - CARPENTER (Wood Frame) - Zone 1

Effective Date - 04/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$19.49	\$7.07	\$0.00	\$0.00	\$26.56
2	60	\$19.49	\$7.07	\$0.00	\$0.00	\$26.56
3	65	\$21.12	\$7.07	\$7.86	\$0.00	\$36.05
4	70	\$22.74	\$7.07	\$7.86	\$0.00	\$37.67
5	75	\$24.37	\$7.07	\$7.86	\$0.00	\$39.30
6	80	\$25.99	\$7.07	\$7.86	\$0.00	\$40.92
7	85	\$27.62	\$7.07	\$7.86	\$0.00	\$42.55
8	90	\$29.24	\$7.07	\$7.86	\$0.00	\$44.17

Effective Date - 10/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$19.78	\$7.07	\$0.00	\$0.00	\$26.85
2	60	\$19.78	\$7.07	\$0.00	\$0.00	\$26.85
3	65	\$21.43	\$7.07	\$7.86	\$0.00	\$36.36
4	70	\$23.08	\$7.07	\$7.86	\$0.00	\$38.01
5	75	\$24.73	\$7.07	\$7.86	\$0.00	\$39.66
6	80	\$26.38	\$7.07	\$7.86	\$0.00	\$41.31
7	85	\$28.02	\$7.07	\$7.86	\$0.00	\$42.95
8	90	\$29.67	\$7.07	\$7.86	\$0.00	\$44.60

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80
 Step 1&2 \$21.69/ 3&4 \$29.69/ 5&6 \$37.67/ 7&8 \$40.92

Apprentice to Journeyworker Ratio:1:5

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

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

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

Effective Date - 01/01/2019

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

Effective Date - 07/01/2019

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

Notes:

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

Apprentice to Journeyworker Ratio:1:3

CHAIN SAW OPERATOR	12/01/2018	\$38.90	\$7.85	\$15.35	\$0.00	\$62.10
LABORERS - ZONE 1	06/01/2019	\$39.90	\$7.85	\$15.35	\$0.00	\$63.10
	12/01/2019	\$40.90	\$7.85	\$15.35	\$0.00	\$64.10
	06/01/2020	\$41.89	\$7.85	\$15.35	\$0.00	\$65.09
	12/01/2020	\$42.87	\$7.85	\$15.35	\$0.00	\$66.07
	06/01/2021	\$43.89	\$7.85	\$15.35	\$0.00	\$67.09
	12/01/2021	\$44.90	\$7.85	\$15.35	\$0.00	\$68.10

For apprentice rates see "Apprentice- LABORER"

CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES	12/01/2018	\$48.58	\$11.50	\$15.60	\$0.00	\$75.68
OPERATING ENGINEERS LOCAL 4	06/01/2019	\$49.68	\$11.50	\$15.60	\$0.00	\$76.78
	12/01/2019	\$50.83	\$11.50	\$15.60	\$0.00	\$77.93
	06/01/2020	\$51.93	\$11.50	\$15.60	\$0.00	\$79.03
	12/01/2020	\$53.08	\$11.50	\$15.60	\$0.00	\$80.18
	06/01/2021	\$54.18	\$11.50	\$15.60	\$0.00	\$81.28
	12/01/2021	\$55.33	\$11.50	\$15.60	\$0.00	\$82.43

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
COMPRESSOR OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$32.03	\$11.50	\$15.60	\$0.00	\$59.13
	06/01/2019	\$32.78	\$11.50	\$15.60	\$0.00	\$59.88
	12/01/2019	\$33.57	\$11.50	\$15.60	\$0.00	\$60.67
	06/01/2020	\$34.32	\$11.50	\$15.60	\$0.00	\$61.42
	12/01/2020	\$35.10	\$11.50	\$15.60	\$0.00	\$62.20
	06/01/2021	\$35.85	\$11.50	\$15.60	\$0.00	\$62.95
	12/01/2021	\$36.64	\$11.50	\$15.60	\$0.00	\$63.74

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

DELEADER (BRIDGE) <i>PAINTERS LOCAL 35 - ZONE 1</i>	01/01/2019	\$50.36	\$8.15	\$20.85	\$0.00	\$79.36
	07/01/2019	\$51.46	\$8.15	\$20.85	\$0.00	\$80.46
	01/01/2020	\$52.56	\$8.15	\$20.85	\$0.00	\$81.56
	07/01/2020	\$53.66	\$8.15	\$20.85	\$0.00	\$82.66
	01/01/2021	\$54.76	\$8.15	\$20.85	\$0.00	\$83.76

Apprentice - PAINTER Local 35 - BRIDGES/TANKS

Effective Date - 01/01/2019

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

Effective Date - 07/01/2019

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

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN <i>LABORERS - ZONE 1</i>	12/01/2018	\$38.80	\$7.85	\$15.35	\$0.00	\$62.00
	06/01/2019	\$39.80	\$7.85	\$15.35	\$0.00	\$63.00
	12/01/2019	\$40.80	\$7.85	\$15.35	\$0.00	\$64.00

For apprentice rates see "Apprentice- LABORER"

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

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - ELECTRICIAN - Local 103

Effective Date - 03/01/2019

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

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

Apprentice to Journeyworker Ratio:2:3***

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

Apprentice - ELEVATOR CONSTRUCTOR - Local 4

Effective Date - 01/01/2019

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

Effective Date - 01/01/2020

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

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

Apprentice to Journeyworker Ratio:1:1

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ELEVATOR CONSTRUCTOR HELPER <i>ELEVATOR CONSTRUCTORS LOCAL 4</i>	01/01/2019	\$41.63	\$15.58	\$17.51	\$0.00	\$74.72
	01/01/2020	\$42.99	\$15.73	\$18.41	\$0.00	\$77.13
	01/01/2021	\$44.43	\$15.88	\$19.31	\$0.00	\$79.62
	01/01/2022	\$45.93	\$16.03	\$20.21	\$0.00	\$82.17
For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"						
FENCE & GUARD RAIL ERECTOR <i>LABORERS - ZONE 1</i>	12/01/2018	\$38.90	\$7.85	\$15.35	\$0.00	\$62.10
	06/01/2019	\$39.90	\$7.85	\$15.35	\$0.00	\$63.10
	12/01/2019	\$40.90	\$7.85	\$15.35	\$0.00	\$64.10
	06/01/2020	\$41.89	\$7.85	\$15.35	\$0.00	\$65.09
	12/01/2020	\$42.87	\$7.85	\$15.35	\$0.00	\$66.07
	06/01/2021	\$43.89	\$7.85	\$15.35	\$0.00	\$67.09
	12/01/2021	\$44.90	\$7.85	\$15.35	\$0.00	\$68.10
For apprentice rates see "Apprentice- LABORER"						
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY <i>OPERATING ENGINEERS LOCAL 4</i>	11/01/2018	\$43.19	\$11.00	\$15.50	\$0.00	\$69.69
	05/01/2019	\$44.33	\$11.00	\$15.50	\$0.00	\$70.83
	11/01/2019	\$45.33	\$11.00	\$15.50	\$0.00	\$71.83
	05/01/2020	\$46.48	\$11.00	\$15.50	\$0.00	\$72.98
	11/01/2020	\$47.48	\$11.00	\$15.50	\$0.00	\$73.98
	05/01/2021	\$48.68	\$11.00	\$15.50	\$0.00	\$75.18
	11/01/2021	\$49.63	\$11.00	\$15.50	\$0.00	\$76.13
	05/01/2022	\$50.78	\$11.00	\$15.50	\$0.00	\$77.28
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY <i>OPERATING ENGINEERS LOCAL 4</i>	11/01/2018	\$44.67	\$11.00	\$15.50	\$0.00	\$71.17
	05/01/2019	\$45.82	\$11.00	\$15.50	\$0.00	\$72.32
	11/01/2019	\$46.83	\$11.00	\$15.50	\$0.00	\$73.33
	05/01/2020	\$47.98	\$11.00	\$15.50	\$0.00	\$74.48
	11/01/2020	\$48.99	\$11.00	\$15.50	\$0.00	\$75.49
	05/01/2021	\$50.15	\$11.00	\$15.50	\$0.00	\$76.65
	11/01/2021	\$51.16	\$11.00	\$15.50	\$0.00	\$77.66
	05/01/2022	\$52.32	\$11.00	\$15.50	\$0.00	\$78.82
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY <i>OPERATING ENGINEERS LOCAL 4</i>	11/01/2018	\$22.45	\$11.00	\$15.50	\$0.00	\$48.95
	05/01/2019	\$23.13	\$11.00	\$15.50	\$0.00	\$49.63
	11/01/2019	\$23.72	\$11.00	\$15.50	\$0.00	\$50.22
	05/01/2020	\$24.39	\$11.00	\$15.50	\$0.00	\$50.89
	11/01/2020	\$24.98	\$11.00	\$15.50	\$0.00	\$51.48
	05/01/2021	\$25.66	\$11.00	\$15.50	\$0.00	\$52.16
	11/01/2021	\$26.26	\$11.00	\$15.50	\$0.00	\$52.76
	05/01/2022	\$26.93	\$11.00	\$15.50	\$0.00	\$53.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIRE ALARM INSTALLER <i>ELECTRICIANS LOCAL 103</i>	03/01/2019	\$51.10	\$13.00	\$18.88	\$0.00	\$82.98
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINTENANCE / COMMISSIONING <i>ELECTRICIANS LOCAL 103</i>	03/01/2019	\$38.33	\$13.00	\$16.82	\$0.00	\$68.15
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIREMAN (ASST. ENGINEER) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$39.13	\$11.50	\$15.60	\$0.00	\$66.23
	06/01/2019	\$40.04	\$11.50	\$15.60	\$0.00	\$67.14
	12/01/2019	\$40.99	\$11.50	\$15.60	\$0.00	\$68.09
	06/01/2020	\$41.90	\$11.50	\$15.60	\$0.00	\$69.00
	12/01/2020	\$42.85	\$11.50	\$15.60	\$0.00	\$69.95
	06/01/2021	\$43.76	\$11.50	\$15.60	\$0.00	\$70.86
	12/01/2021	\$44.71	\$11.50	\$15.60	\$0.00	\$71.81
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER <i>LABORERS - ZONE 1</i>	12/01/2018	\$22.50	\$7.85	\$15.35	\$0.00	\$45.70
	06/01/2019	\$22.50	\$7.85	\$15.35	\$0.00	\$45.70
	12/01/2019	\$23.50	\$7.85	\$15.35	\$0.00	\$46.70
	06/01/2020	\$23.50	\$7.85	\$15.35	\$0.00	\$46.70
	12/01/2020	\$24.50	\$7.85	\$15.35	\$0.00	\$47.70
	06/01/2021	\$24.50	\$7.85	\$15.35	\$0.00	\$47.70
	12/01/2021	\$24.50	\$7.85	\$15.35	\$0.00	\$47.70
For apprentice rates see "Apprentice- LABORER"						
FLOORCOVERER <i>FLOORCOVERERS LOCAL 2168 ZONE 1</i>	03/01/2016	\$42.13	\$9.80	\$17.62	\$0.00	\$69.55

Apprentice - FLOORCOVERER - Local 2168 Zone 1

Effective Date - 03/01/2016

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

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

Apprentice to Journeyworker Ratio:1:1

FORK LIFT/CHERRY PICKER <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$47.58	\$11.50	\$15.60	\$0.00	\$74.68
	06/01/2019	\$48.68	\$11.50	\$15.60	\$0.00	\$75.78
	12/01/2019	\$49.83	\$11.50	\$15.60	\$0.00	\$76.93
	06/01/2020	\$50.93	\$11.50	\$15.60	\$0.00	\$78.03
	12/01/2020	\$52.08	\$11.50	\$15.60	\$0.00	\$79.18
	06/01/2021	\$53.18	\$11.50	\$15.60	\$0.00	\$80.28
	12/01/2021	\$54.33	\$11.50	\$15.60	\$0.00	\$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
GENERATOR/LIGHTING PLANT/HEATERS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$32.03	\$11.50	\$15.60	\$0.00	\$59.13
	06/01/2019	\$32.78	\$11.50	\$15.60	\$0.00	\$59.88
	12/01/2019	\$33.57	\$11.50	\$15.60	\$0.00	\$60.67
	06/01/2020	\$34.32	\$11.50	\$15.60	\$0.00	\$61.42
	12/01/2020	\$35.10	\$11.50	\$15.60	\$0.00	\$62.20
	06/01/2021	\$35.85	\$11.50	\$15.60	\$0.00	\$62.95
	12/01/2021	\$36.64	\$11.50	\$15.60	\$0.00	\$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) <i>GLAZIERS LOCAL 35 (ZONE 1)</i>	01/01/2019	\$45.65	\$8.15	\$20.85	\$0.00	\$74.65
	07/01/2019	\$46.75	\$8.15	\$20.85	\$0.00	\$75.75
	01/01/2020	\$47.85	\$8.15	\$20.85	\$0.00	\$76.85
	07/01/2020	\$48.95	\$8.15	\$20.85	\$0.00	\$77.95
	01/01/2021	\$50.05	\$8.15	\$20.85	\$0.00	\$79.05

Apprentice - GLAZIER - Local 35 Zone 1

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.83	\$8.15	\$0.00	\$0.00	\$30.98
2	55	\$25.11	\$8.15	\$5.64	\$0.00	\$38.90
3	60	\$27.39	\$8.15	\$6.15	\$0.00	\$41.69
4	65	\$29.67	\$8.15	\$6.66	\$0.00	\$44.48
5	70	\$31.96	\$8.15	\$17.78	\$0.00	\$57.89
6	75	\$34.24	\$8.15	\$18.29	\$0.00	\$60.68
7	80	\$36.52	\$8.15	\$18.80	\$0.00	\$63.47
8	90	\$41.09	\$8.15	\$19.83	\$0.00	\$69.07

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.38	\$8.15	\$0.00	\$0.00	\$31.53
2	55	\$25.71	\$8.15	\$5.64	\$0.00	\$39.50
3	60	\$28.05	\$8.15	\$6.15	\$0.00	\$42.35
4	65	\$30.39	\$8.15	\$6.66	\$0.00	\$45.20
5	70	\$32.73	\$8.15	\$17.78	\$0.00	\$58.66
6	75	\$35.06	\$8.15	\$18.29	\$0.00	\$61.50
7	80	\$37.40	\$8.15	\$18.80	\$0.00	\$64.35
8	90	\$42.08	\$8.15	\$19.83	\$0.00	\$70.06

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HOISTING ENGINEER/CRANES/GRADALLS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$47.58	\$11.50	\$15.60	\$0.00	\$74.68
	06/01/2019	\$48.68	\$11.50	\$15.60	\$0.00	\$75.78
	12/01/2019	\$49.83	\$11.50	\$15.60	\$0.00	\$76.93
	06/01/2020	\$50.93	\$11.50	\$15.60	\$0.00	\$78.03
	12/01/2020	\$52.08	\$11.50	\$15.60	\$0.00	\$79.18
	06/01/2021	\$53.18	\$11.50	\$15.60	\$0.00	\$80.28
	12/01/2021	\$54.33	\$11.50	\$15.60	\$0.00	\$81.43

Apprentice - OPERATING ENGINEERS - Local 4

Effective Date - 12/01/2018

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

Effective Date - 06/01/2019

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

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) <i>SHEETMETAL WORKERS LOCAL 17 - A</i>	02/01/2019	\$46.50	\$13.20	\$24.12	\$2.52	\$86.34
	08/01/2019	\$48.10	\$13.20	\$24.12	\$2.56	\$87.98
	02/01/2020	\$49.75	\$13.20	\$24.12	\$2.61	\$89.68
	08/01/2020	\$51.35	\$13.20	\$24.12	\$2.66	\$91.33
	02/01/2021	\$53.00	\$13.20	\$24.12	\$2.71	\$93.03
	08/01/2021	\$54.75	\$13.20	\$24.12	\$2.76	\$94.83
	02/01/2022	\$56.50	\$13.20	\$24.12	\$2.81	\$96.63

For apprentice rates see "Apprentice- SHEET METAL WORKER"

HVAC (ELECTRICAL CONTROLS) <i>ELECTRICIANS LOCAL 103</i>	03/01/2019	\$51.10	\$13.00	\$18.88	\$0.00	\$82.98
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For apprentice rates see "Apprentice- ELECTRICIAN"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HVAC (TESTING AND BALANCING - AIR) <i>SHEETMETAL WORKERS LOCAL 17 - A</i>	02/01/2019	\$46.50	\$13.20	\$24.12	\$2.52	\$86.34
	08/01/2019	\$48.10	\$13.20	\$24.12	\$2.56	\$87.98
	02/01/2020	\$49.75	\$13.20	\$24.12	\$2.61	\$89.68
	08/01/2020	\$51.35	\$13.20	\$24.12	\$2.66	\$91.33
	02/01/2021	\$53.00	\$13.20	\$24.12	\$2.71	\$93.03
	08/01/2021	\$54.75	\$13.20	\$24.12	\$2.76	\$94.83
	02/01/2022	\$56.50	\$13.20	\$24.12	\$2.81	\$96.63
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (TESTING AND BALANCING -WATER) <i>PIPEFITTERS LOCAL 537</i>	03/01/2019	\$53.19	\$10.95	\$19.74	\$0.00	\$83.88
	09/01/2019	\$54.69	\$10.95	\$19.74	\$0.00	\$85.38
	03/01/2020	\$56.19	\$10.95	\$19.74	\$0.00	\$86.88
	09/01/2020	\$57.69	\$10.95	\$19.74	\$0.00	\$88.38
	03/01/2021	\$59.19	\$10.95	\$19.74	\$0.00	\$89.88
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HVAC MECHANIC <i>PIPEFITTERS LOCAL 537</i>	03/01/2019	\$53.19	\$10.95	\$19.74	\$0.00	\$83.88
	09/01/2019	\$54.69	\$10.95	\$19.74	\$0.00	\$85.38
	03/01/2020	\$56.19	\$10.95	\$19.74	\$0.00	\$86.88
	09/01/2020	\$57.69	\$10.95	\$19.74	\$0.00	\$88.38
	03/01/2021	\$59.19	\$10.95	\$19.74	\$0.00	\$89.88
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HYDRAULIC DRILLS <i>LABORERS - ZONE 1</i>	12/01/2018	\$39.40	\$7.85	\$15.35	\$0.00	\$62.60
	06/01/2019	\$40.40	\$7.85	\$15.35	\$0.00	\$63.60
	12/01/2019	\$41.40	\$7.85	\$15.35	\$0.00	\$64.60
	06/01/2020	\$42.39	\$7.85	\$15.35	\$0.00	\$65.59
	12/01/2020	\$43.37	\$7.85	\$15.35	\$0.00	\$66.57
	06/01/2021	\$44.39	\$7.85	\$15.35	\$0.00	\$67.59
	12/01/2021	\$45.40	\$7.85	\$15.35	\$0.00	\$68.60
For apprentice rates see "Apprentice- LABORER"						
INSULATOR (PIPES & TANKS) <i>HEAT & FROST INSULATORS LOCAL 6 (BOSTON)</i>	09/01/2018	\$47.09	\$12.50	\$15.60	\$0.00	\$75.19
	09/01/2019	\$49.59	\$12.50	\$15.60	\$0.00	\$77.69

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

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

Effective Date - 09/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.55	\$12.50	\$11.40	\$0.00	\$47.45
2	60	\$28.25	\$12.50	\$12.24	\$0.00	\$52.99
3	70	\$32.96	\$12.50	\$13.08	\$0.00	\$58.54
4	80	\$37.67	\$12.50	\$13.92	\$0.00	\$64.09

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$24.80	\$12.50	\$11.40	\$0.00	\$48.70
2	60	\$29.75	\$12.50	\$12.24	\$0.00	\$54.49
3	70	\$34.71	\$12.50	\$13.08	\$0.00	\$60.29
4	80	\$39.67	\$12.50	\$13.92	\$0.00	\$66.09

Notes:

Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER <i>IRONWORKERS LOCAL 7 (BOSTON AREA)</i>	09/16/2018	\$46.07	\$8.00	\$22.85	\$0.00	\$76.92
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Apprentice - IRONWORKER - Local 7 Boston

Effective Date - 09/16/2018

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

Notes:

** Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:**

JACKHAMMER & PAVING BREAKER OPERATOR <i>LABORERS - ZONE 1</i>	12/01/2018	\$38.90	\$7.85	\$15.35	\$0.00	\$62.10
	06/01/2019	\$39.90	\$7.85	\$15.35	\$0.00	\$63.10
	12/01/2019	\$40.90	\$7.85	\$15.35	\$0.00	\$64.10
	06/01/2020	\$41.89	\$7.85	\$15.35	\$0.00	\$65.09
	12/01/2020	\$42.87	\$7.85	\$15.35	\$0.00	\$66.07
	06/01/2021	\$43.89	\$7.85	\$15.35	\$0.00	\$67.09
	12/01/2021	\$44.90	\$7.85	\$15.35	\$0.00	\$68.10

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER LABORERS - ZONE 1	12/01/2018	\$38.65	\$7.85	\$15.35	\$0.00	\$61.85
	06/01/2019	\$39.65	\$7.85	\$15.35	\$0.00	\$62.85
	12/01/2019	\$40.65	\$7.85	\$15.35	\$0.00	\$63.85
	06/01/2020	\$41.64	\$7.85	\$15.35	\$0.00	\$64.84
	12/01/2020	\$42.62	\$7.85	\$15.35	\$0.00	\$65.82
	06/01/2021	\$43.64	\$7.85	\$15.35	\$0.00	\$66.84
	12/01/2021	\$44.65	\$7.85	\$15.35	\$0.00	\$67.85

Apprentice - LABORER - Zone 1

Effective Date - 12/01/2018

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

Effective Date - 06/01/2019

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

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER: CARPENTER TENDER LABORERS - ZONE 1	12/01/2018	\$38.65	\$7.85	\$15.35	\$0.00	\$61.85
	06/01/2019	\$39.65	\$7.85	\$15.35	\$0.00	\$62.85
	12/01/2019	\$40.65	\$7.85	\$15.35	\$0.00	\$63.85
	06/01/2020	\$41.64	\$7.85	\$15.35	\$0.00	\$64.84
	12/01/2020	\$42.62	\$7.85	\$15.35	\$0.00	\$65.82
	06/01/2021	\$43.64	\$7.85	\$15.35	\$0.00	\$66.84
	12/01/2021	\$44.65	\$7.85	\$15.35	\$0.00	\$67.85

For apprentice rates see "Apprentice- LABORER"

LABORER: CEMENT FINISHER TENDER LABORERS - ZONE 1	12/01/2018	\$38.65	\$7.85	\$15.35	\$0.00	\$61.85
	06/01/2019	\$39.65	\$7.85	\$15.35	\$0.00	\$62.85
	12/01/2019	\$40.65	\$7.85	\$15.35	\$0.00	\$63.85
	06/01/2020	\$41.64	\$7.85	\$15.35	\$0.00	\$64.84
	12/01/2020	\$42.62	\$7.85	\$15.35	\$0.00	\$65.82
	06/01/2021	\$43.64	\$7.85	\$15.35	\$0.00	\$66.84
	12/01/2021	\$44.65	\$7.85	\$15.35	\$0.00	\$67.85

For apprentice rates see "Apprentice- LABORER"

LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER LABORERS - ZONE 1	12/01/2018	\$38.80	\$7.85	\$15.35	\$0.00	\$62.00
	06/01/2019	\$39.80	\$7.85	\$15.35	\$0.00	\$63.00
	12/01/2019	\$40.80	\$7.85	\$15.35	\$0.00	\$64.00

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

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

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

Effective Date - 02/01/2019

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

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$21.00	\$10.75	\$19.11	\$0.00	\$50.86
2	60	\$25.19	\$10.75	\$19.11	\$0.00	\$55.05
3	70	\$29.39	\$10.75	\$19.11	\$0.00	\$59.25
4	80	\$33.59	\$10.75	\$19.11	\$0.00	\$63.45
5	90	\$37.79	\$10.75	\$19.11	\$0.00	\$67.65

Notes:

Apprentice to Journeyworker Ratio:1:3

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

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

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

Effective Date - 02/01/2019

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

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$27.46	\$10.75	\$20.80	\$0.00	\$59.01
2	60	\$32.95	\$10.75	\$20.80	\$0.00	\$64.50
3	70	\$38.44	\$10.75	\$20.80	\$0.00	\$69.99
4	80	\$43.94	\$10.75	\$20.80	\$0.00	\$75.49
5	90	\$49.43	\$10.75	\$20.80	\$0.00	\$80.98

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$47.10	\$11.50	\$15.60	\$0.00	\$74.20
	06/01/2019	\$48.19	\$11.50	\$15.60	\$0.00	\$75.29
	12/01/2019	\$49.33	\$11.50	\$15.60	\$0.00	\$76.43
	06/01/2020	\$50.41	\$11.50	\$15.60	\$0.00	\$77.51
	12/01/2020	\$51.55	\$11.50	\$15.60	\$0.00	\$78.65
	06/01/2021	\$52.64	\$11.50	\$15.60	\$0.00	\$79.74
	12/01/2021	\$53.78	\$11.50	\$15.60	\$0.00	\$80.88

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MECHANICS MAINTENANCE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$47.10	\$11.50	\$15.60	\$0.00	\$74.20
	06/01/2019	\$48.19	\$11.50	\$15.60	\$0.00	\$75.29
	12/01/2019	\$49.33	\$11.50	\$15.60	\$0.00	\$76.43
	06/01/2020	\$50.41	\$11.50	\$15.60	\$0.00	\$77.51
	12/01/2020	\$51.55	\$11.50	\$15.60	\$0.00	\$78.65
	06/01/2021	\$52.64	\$11.50	\$15.60	\$0.00	\$79.74
	12/01/2021	\$53.78	\$11.50	\$15.60	\$0.00	\$80.88

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MILLWRIGHT (Zone 1) <i>MILLWRIGHTS LOCAL 1121 - Zone 1</i>	04/01/2019	\$42.22	\$9.90	\$18.50	\$0.00	\$70.62
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Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - MILLWRIGHT - Local 1121 Zone 1

Effective Date - 04/01/2019

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

Notes:

Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:5

MORTAR MIXER <i>LABORERS - ZONE 1</i>	12/01/2018	\$38.90	\$7.85	\$15.35	\$0.00	\$62.10
	06/01/2019	\$39.90	\$7.85	\$15.35	\$0.00	\$63.10
	12/01/2019	\$40.90	\$7.85	\$15.35	\$0.00	\$64.10
	06/01/2020	\$41.89	\$7.85	\$15.35	\$0.00	\$65.09
	12/01/2020	\$42.87	\$7.85	\$15.35	\$0.00	\$66.07
	06/01/2021	\$43.89	\$7.85	\$15.35	\$0.00	\$67.09
	12/01/2021	\$44.90	\$7.85	\$15.35	\$0.00	\$68.10

For apprentice rates see "Apprentice- LABORER"

OILER (OTHER THAN TRUCK CRANES,GRADALLS) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$23.06	\$11.50	\$15.60	\$0.00	\$50.16
	06/01/2019	\$23.61	\$11.50	\$15.60	\$0.00	\$50.71
	12/01/2019	\$24.18	\$11.50	\$15.60	\$0.00	\$51.28
	06/01/2020	\$24.73	\$11.50	\$15.60	\$0.00	\$51.83
	12/01/2020	\$25.30	\$11.50	\$15.60	\$0.00	\$52.40
	06/01/2021	\$25.85	\$11.50	\$15.60	\$0.00	\$52.95
	12/01/2021	\$26.43	\$11.50	\$15.60	\$0.00	\$53.53

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

OILER (TRUCK CRANES, GRADALLS) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$27.42	\$11.50	\$15.60	\$0.00	\$54.52
	06/01/2019	\$28.07	\$11.50	\$15.60	\$0.00	\$55.17
	12/01/2019	\$28.74	\$11.50	\$15.60	\$0.00	\$55.84
	06/01/2020	\$29.39	\$11.50	\$15.60	\$0.00	\$56.49
	12/01/2020	\$30.07	\$11.50	\$15.60	\$0.00	\$57.17
	06/01/2021	\$30.71	\$11.50	\$15.60	\$0.00	\$57.81
	12/01/2021	\$31.39	\$11.50	\$15.60	\$0.00	\$58.49

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

OTHER POWER DRIVEN EQUIPMENT - CLASS II <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$47.10	\$11.50	\$15.60	\$0.00	\$74.20
	06/01/2019	\$48.19	\$11.50	\$15.60	\$0.00	\$75.29
	12/01/2019	\$49.33	\$11.50	\$15.60	\$0.00	\$76.43
	06/01/2020	\$50.41	\$11.50	\$15.60	\$0.00	\$77.51
	12/01/2020	\$51.55	\$11.50	\$15.60	\$0.00	\$78.65
	06/01/2021	\$52.64	\$11.50	\$15.60	\$0.00	\$79.74
	12/01/2021	\$53.78	\$11.50	\$15.60	\$0.00	\$80.88

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PAINTER (BRIDGES/TANKS) <i>PAINTERS LOCAL 35 - ZONE 1</i>	01/01/2019	\$50.36	\$8.15	\$20.85	\$0.00	\$79.36
	07/01/2019	\$51.46	\$8.15	\$20.85	\$0.00	\$80.46
	01/01/2020	\$52.56	\$8.15	\$20.85	\$0.00	\$81.56
	07/01/2020	\$53.66	\$8.15	\$20.85	\$0.00	\$82.66
	01/01/2021	\$54.76	\$8.15	\$20.85	\$0.00	\$83.76

Apprentice - PAINTER Local 35 - BRIDGES/TANKS

Effective Date - 01/01/2019

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

Effective Date - 07/01/2019

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

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SIGN, PICTORIAL & DISPLAY) <i>PAINTERS LOCAL 35 - ZONE 1</i>	06/01/2013	\$25.81	\$7.07	\$7.05	\$0.00	\$39.93
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Apprentice - PAINTER SIGN - Local 35 Zone 1

Effective Date - 06/01/2013

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

Notes:
Steps are 4 mos.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, NEW) *	01/01/2019	\$47.05	\$8.15	\$20.85	\$0.00	\$76.05
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. PAINTERS LOCAL 35 - ZONE 1	07/01/2019	\$48.15	\$8.15	\$20.85	\$0.00	\$77.15
	01/01/2020	\$49.25	\$8.15	\$20.85	\$0.00	\$78.25
	07/01/2020	\$50.35	\$8.15	\$20.85	\$0.00	\$79.35
	01/01/2021	\$51.45	\$8.15	\$20.85	\$0.00	\$80.45

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PAINTER Local 35 Zone 1 - Spray/Sandblast - New

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.53	\$8.15	\$0.00	\$0.00	\$31.68
2	55	\$25.88	\$8.15	\$5.64	\$0.00	\$39.67
3	60	\$28.23	\$8.15	\$6.15	\$0.00	\$42.53
4	65	\$30.58	\$8.15	\$6.66	\$0.00	\$45.39
5	70	\$32.94	\$8.15	\$17.78	\$0.00	\$58.87
6	75	\$35.29	\$8.15	\$18.29	\$0.00	\$61.73
7	80	\$37.64	\$8.15	\$18.80	\$0.00	\$64.59
8	90	\$42.35	\$8.15	\$19.83	\$0.00	\$70.33

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$24.08	\$8.15	\$0.00	\$0.00	\$32.23
2	55	\$26.48	\$8.15	\$5.64	\$0.00	\$40.27
3	60	\$28.89	\$8.15	\$6.15	\$0.00	\$43.19
4	65	\$31.30	\$8.15	\$6.66	\$0.00	\$46.11
5	70	\$33.71	\$8.15	\$17.78	\$0.00	\$59.64
6	75	\$36.11	\$8.15	\$18.29	\$0.00	\$62.55
7	80	\$38.52	\$8.15	\$18.80	\$0.00	\$65.47
8	90	\$43.34	\$8.15	\$19.83	\$0.00	\$71.32

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT)	01/01/2019	\$45.11	\$8.15	\$20.85	\$0.00	\$74.11
PAINTERS LOCAL 35 - ZONE 1	07/01/2019	\$46.21	\$8.15	\$20.85	\$0.00	\$75.21
	01/01/2020	\$47.31	\$8.15	\$20.85	\$0.00	\$76.31
	07/01/2020	\$48.41	\$8.15	\$20.85	\$0.00	\$77.41
	01/01/2021	\$49.51	\$8.15	\$20.85	\$0.00	\$78.51

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PAINTER Local 35 Zone 1 - Spray/Sandblast - Repaint

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.56	\$8.15	\$0.00	\$0.00	\$30.71
2	55	\$24.81	\$8.15	\$5.64	\$0.00	\$38.60
3	60	\$27.07	\$8.15	\$6.15	\$0.00	\$41.37
4	65	\$29.32	\$8.15	\$6.66	\$0.00	\$44.13
5	70	\$31.58	\$8.15	\$17.78	\$0.00	\$57.51
6	75	\$33.83	\$8.15	\$18.29	\$0.00	\$60.27
7	80	\$36.09	\$8.15	\$18.80	\$0.00	\$63.04
8	90	\$40.60	\$8.15	\$19.83	\$0.00	\$68.58

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.11	\$8.15	\$0.00	\$0.00	\$31.26
2	55	\$25.42	\$8.15	\$5.64	\$0.00	\$39.21
3	60	\$27.73	\$8.15	\$6.15	\$0.00	\$42.03
4	65	\$30.04	\$8.15	\$6.66	\$0.00	\$44.85
5	70	\$32.35	\$8.15	\$17.78	\$0.00	\$58.28
6	75	\$34.66	\$8.15	\$18.29	\$0.00	\$61.10
7	80	\$36.97	\$8.15	\$18.80	\$0.00	\$63.92
8	90	\$41.59	\$8.15	\$19.83	\$0.00	\$69.57

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (TRAFFIC MARKINGS) LABORERS - ZONE 1	12/01/2018	\$38.65	\$7.85	\$15.35	\$0.00	\$61.85
	06/01/2019	\$39.65	\$7.85	\$15.35	\$0.00	\$62.85
	12/01/2019	\$40.65	\$7.85	\$15.35	\$0.00	\$63.85
	06/01/2020	\$41.64	\$7.85	\$15.35	\$0.00	\$64.84
	12/01/2020	\$42.62	\$7.85	\$15.35	\$0.00	\$65.82
	06/01/2021	\$43.64	\$7.85	\$15.35	\$0.00	\$66.84
	12/01/2021	\$44.65	\$7.85	\$15.35	\$0.00	\$67.85

For Apprentice rates see "Apprentice- LABORER"

PAINTER / TAPER (BRUSH, NEW) *	01/01/2019	\$45.65	\$8.15	\$20.85	\$0.00	\$74.65
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. PAINTERS LOCAL 35 - ZONE 1	07/01/2019	\$46.75	\$8.15	\$20.85	\$0.00	\$75.75
	01/01/2020	\$47.85	\$8.15	\$20.85	\$0.00	\$76.85
	07/01/2020	\$48.95	\$8.15	\$20.85	\$0.00	\$77.95
	01/01/2021	\$50.05	\$8.15	\$20.85	\$0.00	\$79.05

Apprentice - PAINTER - Local 35 Zone 1 - BRUSH NEW

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.83	\$8.15	\$0.00	\$0.00	\$30.98
2	55	\$25.11	\$8.15	\$5.64	\$0.00	\$38.90
3	60	\$27.39	\$8.15	\$6.15	\$0.00	\$41.69
4	65	\$29.67	\$8.15	\$6.66	\$0.00	\$44.48
5	70	\$31.96	\$8.15	\$17.78	\$0.00	\$57.89
6	75	\$34.24	\$8.15	\$18.29	\$0.00	\$60.68
7	80	\$36.52	\$8.15	\$18.80	\$0.00	\$63.47
8	90	\$41.09	\$8.15	\$19.83	\$0.00	\$69.07

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.38	\$8.15	\$0.00	\$0.00	\$31.53
2	55	\$25.71	\$8.15	\$5.64	\$0.00	\$39.50
3	60	\$28.05	\$8.15	\$6.15	\$0.00	\$42.35
4	65	\$30.39	\$8.15	\$6.66	\$0.00	\$45.20
5	70	\$32.73	\$8.15	\$17.78	\$0.00	\$58.66
6	75	\$35.06	\$8.15	\$18.29	\$0.00	\$61.50
7	80	\$37.40	\$8.15	\$18.80	\$0.00	\$64.35
8	90	\$42.08	\$8.15	\$19.83	\$0.00	\$70.06

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT)	01/01/2019	\$43.71	\$8.15	\$20.85	\$0.00	\$72.71
PAINTERS LOCAL 35 - ZONE 1	07/01/2019	\$44.81	\$8.15	\$20.85	\$0.00	\$73.81
	01/01/2020	\$45.91	\$8.15	\$20.85	\$0.00	\$74.91
	07/01/2020	\$47.01	\$8.15	\$20.85	\$0.00	\$76.01
	01/01/2021	\$48.11	\$8.15	\$20.85	\$0.00	\$77.11

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PAINTER Local 35 Zone 1 - BRUSH REPAINT

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$21.86	\$8.15	\$0.00	\$0.00	\$30.01
2	55	\$24.04	\$8.15	\$5.64	\$0.00	\$37.83
3	60	\$26.23	\$8.15	\$6.15	\$0.00	\$40.53
4	65	\$28.41	\$8.15	\$6.66	\$0.00	\$43.22
5	70	\$30.60	\$8.15	\$17.78	\$0.00	\$56.53
6	75	\$32.78	\$8.15	\$18.29	\$0.00	\$59.22
7	80	\$34.97	\$8.15	\$18.80	\$0.00	\$61.92
8	90	\$39.34	\$8.15	\$19.83	\$0.00	\$67.32

Effective Date - 07/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.41	\$8.15	\$0.00	\$0.00	\$30.56
2	55	\$24.65	\$8.15	\$5.64	\$0.00	\$38.44
3	60	\$26.89	\$8.15	\$6.15	\$0.00	\$41.19
4	65	\$29.13	\$8.15	\$6.66	\$0.00	\$43.94
5	70	\$31.37	\$8.15	\$17.78	\$0.00	\$57.30
6	75	\$33.61	\$8.15	\$18.29	\$0.00	\$60.05
7	80	\$35.85	\$8.15	\$18.80	\$0.00	\$62.80
8	90	\$40.33	\$8.15	\$19.83	\$0.00	\$68.31

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

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

Apprentice - PILE DRIVER - Local 56 Zone 1

Effective Date - 08/01/2018

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

Effective Date - 08/01/2019

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

Notes:

Apprentice to Journeyworker Ratio:1:5

PIPEFITTER & STEAMFITTER	03/01/2019	\$53.19	\$10.95	\$19.74	\$0.00	\$83.88
PIPEFITTERS LOCAL 537	09/01/2019	\$54.69	\$10.95	\$19.74	\$0.00	\$85.38
	03/01/2020	\$56.19	\$10.95	\$19.74	\$0.00	\$86.88
	09/01/2020	\$57.69	\$10.95	\$19.74	\$0.00	\$88.38
	03/01/2021	\$59.19	\$10.95	\$19.74	\$0.00	\$89.88

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PIPEFITTER - Local 537

Effective Date - 03/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$21.28	\$10.95	\$8.00	\$0.00	\$40.23
2	45	\$23.94	\$10.95	\$19.74	\$0.00	\$54.63
3	60	\$31.91	\$10.95	\$19.74	\$0.00	\$62.60
4	70	\$37.23	\$10.95	\$19.74	\$0.00	\$67.92
5	80	\$42.55	\$10.95	\$19.74	\$0.00	\$73.24

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$21.88	\$10.95	\$8.00	\$0.00	\$40.83
2	45	\$24.61	\$10.95	\$19.74	\$0.00	\$55.30
3	60	\$32.81	\$10.95	\$19.74	\$0.00	\$63.50
4	70	\$38.28	\$10.95	\$19.74	\$0.00	\$68.97
5	80	\$43.75	\$10.95	\$19.74	\$0.00	\$74.44

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	12/01/2018	\$38.90	\$7.85	\$15.35	\$0.00	\$62.10
LABORERS - ZONE 1	06/01/2019	\$39.90	\$7.85	\$15.35	\$0.00	\$63.10
	12/01/2019	\$40.90	\$7.85	\$15.35	\$0.00	\$64.10
	06/01/2020	\$41.89	\$7.85	\$15.35	\$0.00	\$65.09
	12/01/2020	\$42.87	\$7.85	\$15.35	\$0.00	\$66.07
	06/01/2021	\$43.89	\$7.85	\$15.35	\$0.00	\$67.09
	12/01/2021	\$44.90	\$7.85	\$15.35	\$0.00	\$68.10

For apprentice rates see "Apprentice- LABORER"

PLUMBERS & GASFITTERS	03/01/2019	\$56.69	\$11.82	\$16.51	\$0.00	\$85.02
PLUMBERS & GASFITTERS LOCAL 12	09/01/2019	\$58.19	\$11.82	\$16.51	\$0.00	\$86.52
	03/01/2020	\$59.69	\$11.82	\$16.51	\$0.00	\$88.02
	09/01/2020	\$61.19	\$11.82	\$16.51	\$0.00	\$89.52
	03/01/2021	\$62.69	\$11.82	\$16.51	\$0.00	\$91.02

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PLUMBER/GASFITTER - Local 12

Effective Date - 03/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$19.84	\$11.82	\$5.98	\$0.00	\$37.64
2	40	\$22.68	\$11.82	\$6.79	\$0.00	\$41.29
3	55	\$31.18	\$11.82	\$9.25	\$0.00	\$52.25
4	65	\$36.85	\$11.82	\$10.85	\$0.00	\$59.52
5	75	\$42.52	\$11.82	\$12.50	\$0.00	\$66.84

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$20.37	\$11.82	\$5.98	\$0.00	\$38.17
2	40	\$23.28	\$11.82	\$6.79	\$0.00	\$41.89
3	55	\$32.00	\$11.82	\$9.25	\$0.00	\$53.07
4	65	\$37.82	\$11.82	\$10.85	\$0.00	\$60.49
5	75	\$43.64	\$11.82	\$12.50	\$0.00	\$67.96

Notes:

** 1:2; 2:6; 3:10; 4:14; 5:19/Steps are 1 yr
Step4 with lic\$63.17, Step5 with lic\$70.47

Apprentice to Journeyworker Ratio:**

PNEUMATIC CONTROLS (TEMP.)	03/01/2019	\$53.19	\$10.95	\$19.74	\$0.00	\$83.88
PIPEFITTERS LOCAL 537	09/01/2019	\$54.69	\$10.95	\$19.74	\$0.00	\$85.38
	03/01/2020	\$56.19	\$10.95	\$19.74	\$0.00	\$86.88
	09/01/2020	\$57.69	\$10.95	\$19.74	\$0.00	\$88.38
	03/01/2021	\$59.17	\$10.95	\$19.74	\$0.00	\$89.86

For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"

PNEUMATIC DRILL/TOOL OPERATOR	12/01/2018	\$38.90	\$7.85	\$15.35	\$0.00	\$62.10
LABORERS - ZONE 1	06/01/2019	\$39.90	\$7.85	\$15.35	\$0.00	\$63.10
	12/01/2019	\$40.90	\$7.85	\$15.35	\$0.00	\$64.10
	06/01/2020	\$41.89	\$7.85	\$15.35	\$0.00	\$65.09
	12/01/2020	\$42.87	\$7.85	\$15.35	\$0.00	\$66.07
	06/01/2021	\$43.89	\$7.85	\$15.35	\$0.00	\$67.09
	12/01/2021	\$44.90	\$7.85	\$15.35	\$0.00	\$68.10

For apprentice rates see "Apprentice- LABORER"

POWDERMAN & BLASTER	12/01/2018	\$39.65	\$7.85	\$15.35	\$0.00	\$62.85
LABORERS - ZONE 1	06/01/2019	\$40.65	\$7.85	\$15.35	\$0.00	\$63.85
	12/01/2019	\$41.65	\$7.85	\$15.35	\$0.00	\$64.85
	06/01/2020	\$42.64	\$7.85	\$15.35	\$0.00	\$65.84
	12/01/2020	\$43.62	\$7.85	\$15.35	\$0.00	\$66.82
	06/01/2021	\$44.64	\$7.85	\$15.35	\$0.00	\$67.84
	12/01/2021	\$45.65	\$7.85	\$15.35	\$0.00	\$68.85

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
POWER SHOVEL/DERRICK/TRENCHING MACHINE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$47.58	\$11.50	\$15.60	\$0.00	\$74.68
	06/01/2019	\$48.68	\$11.50	\$15.60	\$0.00	\$75.78
	12/01/2019	\$49.83	\$11.50	\$15.60	\$0.00	\$76.93
	06/01/2020	\$50.93	\$11.50	\$15.60	\$0.00	\$78.03
	12/01/2020	\$52.08	\$11.50	\$15.60	\$0.00	\$79.18
	06/01/2021	\$53.18	\$11.50	\$15.60	\$0.00	\$80.28
	12/01/2021	\$54.33	\$11.50	\$15.60	\$0.00	\$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (CONCRETE) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$47.58	\$11.50	\$15.60	\$0.00	\$74.68
	06/01/2019	\$48.68	\$11.50	\$15.60	\$0.00	\$75.78
	12/01/2019	\$49.83	\$11.50	\$15.60	\$0.00	\$76.93
	06/01/2020	\$50.93	\$11.50	\$15.60	\$0.00	\$78.03
	12/01/2020	\$52.08	\$11.50	\$15.60	\$0.00	\$79.18
	06/01/2021	\$53.18	\$11.50	\$15.60	\$0.00	\$80.28
	12/01/2021	\$54.33	\$11.50	\$15.60	\$0.00	\$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$32.03	\$11.50	\$15.60	\$0.00	\$59.13
	06/01/2019	\$32.78	\$11.50	\$15.60	\$0.00	\$59.88
	12/01/2019	\$33.57	\$11.50	\$15.60	\$0.00	\$60.67
	06/01/2020	\$34.32	\$11.50	\$15.60	\$0.00	\$61.42
	12/01/2020	\$35.10	\$11.50	\$15.60	\$0.00	\$62.20
	06/01/2021	\$35.85	\$11.50	\$15.60	\$0.00	\$62.95
	12/01/2021	\$36.64	\$11.50	\$15.60	\$0.00	\$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY MIX CONCRETE DRIVERS after 4/30/10 (Drivers Hired After 4/30/2010) <i>TEAMSTERS LOCAL 25a</i>	07/01/2017	\$28.18	\$8.48	\$9.72	\$0.00	\$46.38
READY-MIX CONCRETE DRIVER <i>TEAMSTERS LOCAL 25a</i>	07/01/2017	\$31.44	\$8.48	\$9.72	\$0.00	\$49.64
RECLAIMERS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$47.10	\$11.50	\$15.60	\$0.00	\$74.20
	06/01/2019	\$48.19	\$11.50	\$15.60	\$0.00	\$75.29
	12/01/2019	\$49.33	\$11.50	\$15.60	\$0.00	\$76.43
	06/01/2020	\$50.41	\$11.50	\$15.60	\$0.00	\$77.51
	12/01/2020	\$51.55	\$11.50	\$15.60	\$0.00	\$78.65
	06/01/2021	\$52.64	\$11.50	\$15.60	\$0.00	\$79.74
	12/01/2021	\$53.78	\$11.50	\$15.60	\$0.00	\$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
RIDE-ON MOTORIZED BUGGY OPERATOR <i>LABORERS - ZONE 1</i>	12/01/2018	\$38.90	\$7.85	\$15.35	\$0.00	\$62.10
	06/01/2019	\$39.90	\$7.85	\$15.35	\$0.00	\$63.10
	12/01/2019	\$40.90	\$7.85	\$15.35	\$0.00	\$64.10
	06/01/2020	\$41.89	\$7.85	\$15.35	\$0.00	\$65.09
	12/01/2020	\$42.87	\$7.85	\$15.35	\$0.00	\$66.07
	06/01/2021	\$43.89	\$7.85	\$15.35	\$0.00	\$67.09
	12/01/2021	\$44.90	\$7.85	\$15.35	\$0.00	\$68.10
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ROLLER/SPREADER/MULCHING MACHINE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$47.10	\$11.50	\$15.60	\$0.00	\$74.20
	06/01/2019	\$48.19	\$11.50	\$15.60	\$0.00	\$75.29
	12/01/2019	\$49.33	\$11.50	\$15.60	\$0.00	\$76.43
	06/01/2020	\$50.41	\$11.50	\$15.60	\$0.00	\$77.51
	12/01/2020	\$51.55	\$11.50	\$15.60	\$0.00	\$78.65
	06/01/2021	\$52.64	\$11.50	\$15.60	\$0.00	\$79.74
	12/01/2021	\$53.78	\$11.50	\$15.60	\$0.00	\$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
ROOFER (Inc.Roofing Waterproofing &Roofing Damproofg) <i>ROOFERS LOCAL 33</i>	02/01/2019	\$43.36	\$11.50	\$15.90	\$0.00	\$70.76

Apprentice - ROOFER - Local 33

Effective Date - 02/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$21.68	\$11.50	\$3.69	\$0.00	\$36.87
2	60	\$26.02	\$11.50	\$15.90	\$0.00	\$53.42
3	65	\$28.18	\$11.50	\$15.90	\$0.00	\$55.58
4	75	\$32.52	\$11.50	\$15.90	\$0.00	\$59.92
5	85	\$36.86	\$11.50	\$15.90	\$0.00	\$64.26

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

Apprentice to Journeyworker Ratio:**

ROOFER SLATE / TILE / PRECAST CONCRETE <i>ROOFERS LOCAL 33</i>	02/01/2019	\$43.61	\$11.50	\$15.90	\$0.00	\$71.01
For apprentice rates see "Apprentice- ROOFER"						
SHEETMETAL WORKER <i>SHEETMETAL WORKERS LOCAL 17 - A</i>	02/01/2019	\$46.50	\$13.20	\$24.12	\$2.52	\$86.34
	08/01/2019	\$48.10	\$13.20	\$24.12	\$2.56	\$87.98
	02/01/2020	\$49.75	\$13.20	\$24.12	\$2.61	\$89.68
	08/01/2020	\$51.35	\$13.20	\$24.12	\$2.66	\$91.33
	02/01/2021	\$53.00	\$13.20	\$24.12	\$2.71	\$93.03
	08/01/2021	\$54.75	\$13.20	\$24.12	\$2.76	\$94.83
	02/01/2022	\$56.50	\$13.20	\$24.12	\$2.81	\$96.63

Apprentice - SHEET METAL WORKER - Local 17-A

Effective Date - 02/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	42	\$19.53	\$13.20	\$5.89	\$0.00	\$38.62
2	42	\$19.53	\$13.20	\$5.89	\$0.00	\$38.62
3	47	\$21.86	\$13.20	\$11.13	\$1.39	\$47.58
4	47	\$21.86	\$13.20	\$11.13	\$1.39	\$47.58
5	52	\$24.18	\$13.20	\$12.08	\$1.48	\$50.94
6	52	\$24.18	\$13.20	\$12.33	\$1.49	\$51.20
7	60	\$27.90	\$13.20	\$13.70	\$1.64	\$56.44
8	65	\$30.23	\$13.20	\$14.65	\$1.74	\$59.82
9	75	\$34.88	\$13.20	\$16.56	\$1.94	\$66.58
10	85	\$39.53	\$13.20	\$17.96	\$2.12	\$72.81

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	42	\$20.20	\$13.20	\$5.89	\$0.00	\$39.29
2	42	\$20.20	\$13.20	\$5.89	\$0.00	\$39.29
3	47	\$22.61	\$13.20	\$11.13	\$1.41	\$48.35
4	47	\$22.61	\$13.20	\$11.13	\$1.41	\$48.35
5	52	\$25.01	\$13.20	\$12.08	\$1.51	\$51.80
6	52	\$25.01	\$13.20	\$12.33	\$1.52	\$52.06
7	60	\$28.86	\$13.20	\$13.70	\$1.67	\$57.43
8	65	\$31.27	\$13.20	\$14.65	\$1.77	\$60.89
9	75	\$36.08	\$13.20	\$16.56	\$1.98	\$67.82
10	85	\$40.89	\$13.20	\$17.96	\$2.16	\$74.21

Notes:
Steps are 6 mos.

Apprentice to Journeyworker Ratio:1:4

SPECIALIZED EARTH MOVING EQUIP < 35 TONS	12/01/2018	\$34.64	\$11.91	\$12.70	\$0.00	\$59.25
TEAMSTERS JOINT COUNCIL NO. 10 ZONE A	06/01/2019	\$35.64	\$11.91	\$12.70	\$0.00	\$60.25
	08/01/2019	\$35.64	\$12.41	\$12.70	\$0.00	\$60.75
	12/01/2019	\$35.64	\$12.41	\$13.72	\$0.00	\$61.77
	06/01/2020	\$36.54	\$12.41	\$13.72	\$0.00	\$62.67
	08/01/2020	\$36.54	\$12.91	\$13.72	\$0.00	\$63.17
	12/01/2020	\$36.54	\$12.91	\$14.82	\$0.00	\$64.27
	06/01/2021	\$37.34	\$12.91	\$14.82	\$0.00	\$65.07
	08/01/2021	\$37.34	\$13.41	\$14.82	\$0.00	\$65.57
	12/01/2021	\$37.34	\$13.41	\$16.01	\$0.00	\$66.76

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
SPECIALIZED EARTH MOVING EQUIP > 35 TONS <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE A</i>	12/01/2018	\$34.93	\$11.91	\$12.70	\$0.00	\$59.54
	06/01/2019	\$35.93	\$11.91	\$12.70	\$0.00	\$60.54
	08/01/2019	\$35.93	\$12.41	\$12.70	\$0.00	\$61.04
	12/01/2019	\$35.93	\$12.41	\$13.72	\$0.00	\$62.06
	06/01/2020	\$36.83	\$12.41	\$13.72	\$0.00	\$62.96
	08/01/2020	\$36.83	\$12.91	\$13.72	\$0.00	\$63.46
	12/01/2020	\$36.83	\$12.91	\$14.82	\$0.00	\$64.56
	06/01/2021	\$37.63	\$12.91	\$14.82	\$0.00	\$65.36
	08/01/2021	\$37.63	\$13.41	\$14.82	\$0.00	\$65.86
	12/01/2021	\$37.63	\$13.41	\$16.01	\$0.00	\$67.05
SPRINKLER FITTER <i>SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1</i>	03/01/2019	\$58.98	\$9.47	\$19.60	\$0.00	\$88.05
	10/01/2019	\$60.48	\$9.47	\$19.60	\$0.00	\$89.55
	03/01/2020	\$61.98	\$9.47	\$19.60	\$0.00	\$91.05
	10/01/2020	\$63.48	\$9.47	\$19.60	\$0.00	\$92.55
	03/01/2021	\$64.98	\$9.47	\$19.60	\$0.00	\$94.05

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

Effective Date - 03/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$20.64	\$9.47	\$9.10	\$0.00	\$39.21
2	40	\$23.59	\$9.47	\$9.10	\$0.00	\$42.16
3	45	\$26.54	\$9.47	\$9.10	\$0.00	\$45.11
4	50	\$29.49	\$9.47	\$9.10	\$0.00	\$48.06
5	55	\$32.44	\$9.47	\$9.10	\$0.00	\$51.01
6	60	\$35.39	\$9.47	\$10.60	\$0.00	\$55.46
7	65	\$38.34	\$9.47	\$10.60	\$0.00	\$58.41
8	70	\$41.29	\$9.47	\$10.60	\$0.00	\$61.36
9	75	\$44.24	\$9.47	\$10.60	\$0.00	\$64.31
10	80	\$47.18	\$9.47	\$10.60	\$0.00	\$67.25

Effective Date - 10/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$21.17	\$9.47	\$9.10	\$0.00	\$39.74
2	40	\$24.19	\$9.47	\$9.10	\$0.00	\$42.76
3	45	\$27.22	\$9.47	\$9.10	\$0.00	\$45.79
4	50	\$30.24	\$9.47	\$9.10	\$0.00	\$48.81
5	55	\$33.26	\$9.47	\$9.10	\$0.00	\$51.83
6	60	\$36.29	\$9.47	\$10.60	\$0.00	\$56.36
7	65	\$39.31	\$9.47	\$10.60	\$0.00	\$59.38
8	70	\$42.34	\$9.47	\$10.60	\$0.00	\$62.41
9	75	\$45.36	\$9.47	\$10.60	\$0.00	\$65.43
10	80	\$48.38	\$9.47	\$10.60	\$0.00	\$68.45

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

Apprentice to Journeyworker Ratio:1:3

STEAM BOILER OPERATOR	12/01/2018	\$47.10	\$11.50	\$15.60	\$0.00	\$74.20
OPERATING ENGINEERS LOCAL 4	06/01/2019	\$48.19	\$11.50	\$15.60	\$0.00	\$75.29
	12/01/2019	\$49.33	\$11.50	\$15.60	\$0.00	\$76.43
	06/01/2020	\$50.41	\$11.50	\$15.60	\$0.00	\$77.51
	12/01/2020	\$51.55	\$11.50	\$15.60	\$0.00	\$78.65
	06/01/2021	\$52.64	\$11.50	\$15.60	\$0.00	\$79.74
	12/01/2021	\$53.78	\$11.50	\$15.60	\$0.00	\$80.88

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

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

Apprentice - TELECOMMUNICATION TECHNICIAN - Local 103

Effective Date - 03/01/2019

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

Notes:

Apprentice to Journeyworker Ratio:1:1

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

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - TERRAZZO FINISHER - Local 3 Marble & Tile

Effective Date - 02/01/2019

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

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$26.92	\$10.75	\$20.80	\$0.00	\$58.47
2	60	\$32.30	\$10.75	\$20.80	\$0.00	\$63.85
3	70	\$37.69	\$10.75	\$20.80	\$0.00	\$69.24
4	80	\$43.07	\$10.75	\$20.80	\$0.00	\$74.62
5	90	\$48.46	\$10.75	\$20.80	\$0.00	\$80.01

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER <i>LABORERS - FOUNDATION AND MARINE</i>	12/01/2018	\$40.00	\$7.85	\$15.55	\$0.00	\$63.40
	06/01/2019	\$41.00	\$7.85	\$15.55	\$0.00	\$64.40
	12/01/2019	\$42.00	\$7.85	\$15.55	\$0.00	\$65.40
	06/01/2020	\$42.99	\$7.85	\$15.55	\$0.00	\$66.39
	12/01/2020	\$43.97	\$7.85	\$15.55	\$0.00	\$67.37
	06/01/2021	\$44.99	\$7.85	\$15.55	\$0.00	\$68.39
	12/01/2021	\$46.00	\$7.85	\$15.55	\$0.00	\$69.40

For apprentice rates see "Apprentice- LABORER"

TEST BORING DRILLER HELPER <i>LABORERS - FOUNDATION AND MARINE</i>	12/01/2018	\$38.72	\$7.85	\$15.55	\$0.00	\$62.12
	06/01/2019	\$39.72	\$7.85	\$15.55	\$0.00	\$63.12
	12/01/2019	\$40.72	\$7.85	\$15.55	\$0.00	\$64.12
	06/01/2020	\$41.71	\$7.85	\$15.55	\$0.00	\$65.11
	12/01/2020	\$42.69	\$7.85	\$15.55	\$0.00	\$66.09
	06/01/2021	\$43.71	\$7.85	\$15.55	\$0.00	\$67.11
	12/01/2021	\$44.72	\$7.85	\$15.55	\$0.00	\$68.12

For apprentice rates see "Apprentice- LABORER"

TEST BORING LABORER <i>LABORERS - FOUNDATION AND MARINE</i>	12/01/2018	\$38.60	\$7.85	\$15.55	\$0.00	\$62.00
	06/01/2019	\$39.60	\$7.85	\$15.55	\$0.00	\$63.00
	12/01/2019	\$40.60	\$7.85	\$15.55	\$0.00	\$64.00
	06/01/2020	\$41.59	\$7.85	\$15.55	\$0.00	\$64.99
	12/01/2020	\$42.57	\$7.85	\$15.55	\$0.00	\$65.97
	06/01/2021	\$43.59	\$7.85	\$15.55	\$0.00	\$66.99
	12/01/2021	\$44.60	\$7.85	\$15.55	\$0.00	\$68.00

For apprentice rates see "Apprentice- LABORER"

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

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TUNNEL WORK - FREE AIR (HAZ. WASTE) <i>LABORERS (FREE AIR TUNNEL)</i>	12/01/2018	\$44.95	\$7.85	\$15.95	\$0.00	\$68.75
	06/01/2019	\$45.95	\$7.85	\$15.95	\$0.00	\$69.75
	12/01/2019	\$46.95	\$7.85	\$15.95	\$0.00	\$70.75
	06/01/2020	\$47.94	\$7.85	\$15.95	\$0.00	\$71.74
	12/01/2020	\$48.92	\$7.85	\$15.95	\$0.00	\$72.72
	06/01/2021	\$49.94	\$7.85	\$15.95	\$0.00	\$73.74
	12/01/2021	\$50.95	\$7.85	\$15.95	\$0.00	\$74.75
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE A</i>	12/01/2018	\$34.64	\$11.91	\$12.70	\$0.00	\$59.25
	06/01/2019	\$35.64	\$11.91	\$12.70	\$0.00	\$60.25
	08/01/2019	\$35.64	\$12.41	\$12.70	\$0.00	\$60.75
	12/01/2019	\$35.64	\$12.41	\$13.72	\$0.00	\$61.77
	06/01/2020	\$36.54	\$12.41	\$13.72	\$0.00	\$62.67
	08/01/2020	\$36.54	\$12.91	\$13.72	\$0.00	\$63.17
	12/01/2020	\$36.54	\$12.91	\$14.82	\$0.00	\$64.27
	06/01/2021	\$37.34	\$12.91	\$14.82	\$0.00	\$65.07
	08/01/2021	\$37.34	\$13.41	\$14.82	\$0.00	\$65.57
	12/01/2021	\$37.34	\$13.41	\$16.01	\$0.00	\$66.76
WAGON DRILL OPERATOR <i>LABORERS - ZONE 1</i>	12/01/2018	\$38.90	\$7.85	\$15.35	\$0.00	\$62.10
	06/01/2019	\$39.90	\$7.85	\$15.35	\$0.00	\$63.10
	12/01/2019	\$40.90	\$7.85	\$15.35	\$0.00	\$64.10
	06/01/2020	\$41.89	\$7.85	\$15.35	\$0.00	\$65.09
	12/01/2020	\$42.87	\$7.85	\$15.35	\$0.00	\$66.07
	06/01/2021	\$43.89	\$7.85	\$15.35	\$0.00	\$67.09
	12/01/2021	\$44.90	\$7.85	\$15.35	\$0.00	\$68.10
For apprentice rates see "Apprentice- LABORER"						
WASTE WATER PUMP OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2018	\$47.58	\$11.50	\$15.60	\$0.00	\$74.68
	06/01/2019	\$48.68	\$11.50	\$15.60	\$0.00	\$75.78
	12/01/2019	\$49.83	\$11.50	\$15.60	\$0.00	\$76.93
	06/01/2020	\$50.93	\$11.50	\$15.60	\$0.00	\$78.03
	12/01/2020	\$52.08	\$11.50	\$15.60	\$0.00	\$79.18
	06/01/2021	\$53.18	\$11.50	\$15.60	\$0.00	\$80.28
	12/01/2021	\$54.33	\$11.50	\$15.60	\$0.00	\$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER <i>PLUMBERS & GASFITTERS LOCAL 12</i>	03/01/2019	\$56.69	\$11.82	\$16.51	\$0.00	\$85.02
	09/01/2019	\$58.19	\$11.82	\$16.51	\$0.00	\$86.52
	03/01/2020	\$59.69	\$11.82	\$16.51	\$0.00	\$88.02
	09/01/2020	\$61.19	\$11.82	\$16.51	\$0.00	\$89.52
	03/01/2021	\$62.69	\$11.82	\$16.51	\$0.00	\$91.02
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	09/03/2017	\$27.14	\$7.75	\$1.81	\$0.00	\$36.70
For apprentice rates see "Apprentice- LINEMAN"						
CABLEMAN (Underground Ducts & Cables) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	09/03/2017	\$38.45	\$7.75	\$9.53	\$0.00	\$55.73
For apprentice rates see "Apprentice- LINEMAN"						

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

Apprentice - LINEMAN (Outside Electrical) - East Local 104

Effective Date - 09/03/2017

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

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	02/04/2019	\$30.73	\$4.70	\$3.17	\$0.00	\$38.60
TELEDATA LINEMAN/EQUIPMENT OPERATOR <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	02/04/2019	\$28.93	\$4.70	\$3.14	\$0.00	\$36.77
TELEDATA WIREMAN/INSTALLER/TECHNICIAN <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	02/04/2019	\$28.93	\$4.70	\$3.14	\$0.00	\$36.77
TREE TRIMMER <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i> This classification applies only to tree work done: (a) for a utility company, R.E.A. cooperative, or railroad or coal mining company, and (b) for the purpose of operating, maintaining, or repairing the utility company's equipment, and (c) by a person who is using hand or mechanical cutting methods and is not on the ground. This classification does not apply to wholesale tree removal.	01/31/2016	\$18.51	\$3.55	\$0.00	\$0.00	\$22.06
TREE TRIMMER GROUNDMAN <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	01/31/2016	\$16.32	\$3.55	\$0.00	\$0.00	\$19.87

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

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

Additional 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.)

Ratios are expressed in allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified.

** Multiple ratios are listed in the comment field.

*** APP to JM; 1:1, 2:2, 2:3, 3:4, 4:4, 4:5, 4:6, 5:7, 6:7, 6:8, 6:9, 7:10, 8:10, 8:11, 8:12, 9:13, 10:13, 10:14, etc.

**** APP to JM; 1:1, 1:2, 2:3, 2:4, 3:5, 4:6, 4:7, 5:8, 6:9, 6:10, 7:11, 8:12, 8:13, 9:14, 10:15, 10:16, etc.

MASSACHUSETTS WEEKLY CERTIFIED PAYROLL REPORT FORM



Company's Name:	Address:	Phone No.:	Payroll No.:
Employer's Signature:	Title:	Contract No.:	Work Week Ending:
Awarding Authority's Name:	Public Works Project Name:	Public Works Project Location:	Min. Wage Rate Sheet Number:

Employee Name & Complete Address	Work Classification:	Employee Is OSHA 10 certified (?)	Appr. Rate (%)	Hours Worked							Project Hours (A) All Other Hours	Hourly Base Wage (B)	Health & Welfare Insurance (C)	ERISA Pension Plan (D)	Supp. Unemp. (E)	Total Hourly Prev. Wage (F)	Project Gross Wages (A x F)	Check No. (H)
				Su.	Mo.	Tu.	We.	Th.	Fr.	Sa.								
				Subcontractor's Name:														

Are all apprentice employees identified above currently registered with the MA DLS's Division of Apprentices Standards? YES NO

For all apprentices performing work during the reporting period, attach a copy of the apprentice identification card issued by the Massachusetts Department of Labor Standards / Division of Apprentices Standards.

NOTE: Pursuant to MGL c. 149, s. 27B, every contractor and subcontractor is required to submit a **true and accurate** copy of their certified weekly payroll records to the awarding authority by first-class mail or e-mail. In addition, each weekly payroll must be accompanied by a statement of compliance signed by the employer. Failure to comply may result in the commencement of a criminal action or the issuance of a civil citation.

Date Received 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 is available from the Department of Labor Standards (DLS) at www.mass.gov/dols/pw 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.

On a weekly basis, every contractor and subcontractor is required to submit a certified copy of their weekly payroll records to the awarding authority; this includes the payroll forms and the Statement of Compliance form. The certified payroll records must be submitted either by regular mail or by e-mail to the awarding authority. Once collected, the awarding authority is required to preserve those records for three years from the date of completion of the project.

Each such contractor and subcontractor shall furnish weekly **and** within 15 days after completion of its portion of the work, to the awarding authority directly by first-class mail or e-mail, a statement, executed by the contractor, subcontractor or by any authorized officer thereof who supervised the payment of wages, this form, accompanied by their payroll:

STATEMENT OF COMPLIANCE

_____, 20____

I, _____, _____
(Name of signatory party) (Title)

do hereby state:

That I pay or supervise the payment of the persons employed by

_____ on the _____
(Contractor, subcontractor or public body) (Building or project)

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.

Signature _____

Title _____

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 venturers.

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:

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.

2.3.7. Mechanical, Electrical, and Fire Protection Plans. The mechanical, electrical, and fire protection Plans are diagrammatic only and are not intended to show the alignment, physical locations, or configurations of such Work. Such Work shall be installed without additional cost to the **City** to clear all obstructions, permit proper clearances for the Work of other trades, and present an orderly appearance where exposed. Prior to beginning such Work, the **Contractor** shall prepare Coordination Drawings and demonstrate to the **Engineer's** satisfaction that the

installations will comply with the preceding sentence. The **Contractor** shall be solely liable and responsible for any costs and/or delays resulting from the **Contractor's** failure to prepare such Coordination Drawings.

2.3.8. Locations of Fixtures and Outlets. Exact locations of fixtures and outlets shall be obtained from the **Engineer** as provided in Article 5 before the Work is roughed in. Work installed without such information from the **Engineer** shall be relocated at the **Contractor's** expense.

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).

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.

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.

5.6.4. Building Grades, Lines, Etc. The **Contractor** shall establish the building grades; lines; levels; and 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.

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.

5.9.1. 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.

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; and

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.

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 ___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. 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 purposed 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.

5.19.3.1. 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.

5.19.3.2. All costs associated with delivery of Samples will paid by the **Contractor**.

5.19.4. Contractor's Verifications. Before submitting each Submittal, the **Contractor** shall have determined and verified:

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

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

5.19.4.3. 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.

5.19.5. 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. 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.

5.19.7. 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.

5.19.8. 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.

5.19.9. 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.

5.19.9.1. 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.

5.19.10. 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.

5.19.11. 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.

5.19.12. 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**.

5.19.13. Informational Submittals. Informational Submittals upon which the **Engineer** is not expected to take responsive action may be so identified in the Contract Documents.

5.19.14. 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.

5.21. 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.

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.

5.23. 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.

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 subrogee 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.

ARTICLE 6 SUBCONTRACTORS

6.1. Use of Subcontractors.

6.1.1. The **Contractor** shall use the Subcontractors named in the **Contractor's Bid**.

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.

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.

7.3. 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.

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.

8.2 Additional Insured.

8.2.1. Each policy excluding only the Worker's Compensation and Owners Protective Liability 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. Failure to provide and continue in force 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.

8.5. 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 and beyond as specified in the following sections.

8.8. Policies and Limits.

8.8.1. The insurance required shall include all major division of coverage and shall be on a [comprehensive] commercial general form basis including Premise and Operations (including X-C-U), bodily injury(including death);broad form property damage (including completed operations) including injury to, or destruction of tangible property, including loss of use therefrom; personal injury; Owner’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

The **Contractor** shall purchase and maintain coverage for bodily injury and property damage resulting from liability arising out of pollution related exposures such as mold, fungi, or bacteria abatement, asbestos abatement, lead paint abatement, tank removal, removal of contaminated soil, etc. The insurance policy shall cover the liability of the Contractor during the processes of identification, removal, storage, transport and disposal of hazardous waste, lead, contaminated soil and/or asbestos abatement. The policy shall include coverage for on-Site and off-Site bodily injury and loss of, damage to, or loss of use of property, directly or indirectly arising out of the discharge, dispersal, release or escape of smoke, vapors, soot, fumes, acids, alkalis, toxic chemicals, liquids or gas, waste materials or other irritants, contaminants or pollutants into or upon the land, the atmosphere or any water course or body of water, whether it be gradual or sudden and accidental. The policy shall also include defense and clean-up costs. The City shall be named as an additional insured and coverage must be on an occurrence basis.

Excess Umbrella Liability

Combined single limit	\$15 Million
General aggregate	\$15 Million

Worker's Compensation

Coverage A	Statutory	
Coverage B	Each Accident	\$100,000
	Disease-Policy limit	\$500,000
	Disease-Each Employee	\$100,000

8.9. Excess Umbrella 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 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. If requested by the City the **Contractor** will provide complete certified copies of every insurance policy before commencing and during performance of the Contract.

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 intend to purchase property insurance covering the Project or the Work. The **Contractor** shall not be required to provide such insurance, and 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 **City'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**.

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.

10.3. 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 5.16 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**.

13.2.6. Within fifteen days after receipt from the **Contractor**, at the place designated by the awarding authority if such a place is so designated, of a periodic estimate requesting payment of the amount due for the preceding month, the awarding authority will make a periodic payment to the **Contractor** for the work performed during the preceding month and for the materials not incorporated in the work but delivered and suitably stored at the site (or at some location agreed upon in writing) to which the **Contractor** has title or to which a subcontractor has title and has authorized the **Contractor** to transfer title to the awarding authority, less (1) a retention based on its estimate of the fair value of its claims against the **Contractor** and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, and less (3) a retention not exceeding five per cent of the approved amount of the periodic payment. After the receipt of a periodic estimate requesting final payment and within sixty-five days after (a) the **Contractor** fully completes the work or substantially completes the work so that the value of the work remaining to be done is, in the estimate of the awarding authority, less than one per cent of the original contract price, or (b) the Contractor substantially completes the work and the awarding authority takes possession for occupancy, whichever occurs first, the awarding authority shall pay the Contractor the entire balance due on the contract less (1) a retention based on its estimate of the fair value of its claims against the Contractor and of the cost of completing the incomplete and unsatisfactory items of work and less (2) a retention for direct payments to subcontractors based on demands for same in accordance with the provisions of section thirty-nine F, or based on the record of payments by the **Contractor** to the subcontractors under this contract if such record of payment indicates that the **Contractor** has not paid subcontractors as provided in section thirty-nine F. If the awarding authority fails to make payment as herein provided, there shall be added to each such payment daily interest at the rate of three percentage points above the rediscount rate than charged by the Federal Reserve Bank of Boston commencing on the first day after said payment is due and continuing until the payment is delivered or mailed to the **Contractor**; provided, that no interest shall be due, in any event, on the amount due on a periodic estimate for final payment until fifteen days (twenty-four days in the case of the commonwealth) after receipt of such a periodic estimate from the **Contractor**, at the place designated by the awarding authority if such a place is so designated. The **Contractor** agrees to pay to each subcontractor a portion of any such interest paid in accordance with the amount due each subcontractor.

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

periodic estimates shall contain a separate item for each filed subtrade and each sub-subtrade listed in sub-bid form as required by specifications and a column listing the amount paid to each subcontractor and sub-subcontractor as of the date the periodic estimate is filed. The person making payment for the awarding authority shall add the daily interest provided for herein to each payment for each day beyond the due date based on the date of receipt marked on the estimate.

A certificate of the architect to the effect that the Contractor has fully or substantially completed the work shall, subject to the provisions of section thirty-nine J, be conclusive for the purposes of this section. (*Reference: M.G.L. c. 30, §39K.*)

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 incumbrances.

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, materialpersons, 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 hereinabove 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
795 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

DOCUMENT 00811
SPECIAL PROVISIONS
MONTHLY PRICE ADJUSTMENT FOR HOT MIX ASPHALT (HMA) MIXTURES
ENGLISH UNITS
Revised: 02/02/2009

This provision applies to all projects using greater than 100 tons of hot mix asphalt (HMA) mixtures containing liquid asphalt cement as stipulated in the Notice to Contractors section of the bid documents.

The Price Adjustment will be based on the variance in price for the liquid asphalt component only from the Base Price to the Period Price. It shall not include transportation or other charges. This Price Adjustment will occur on a monthly basis.

Base Price

The Base Price of liquid asphalt on a project as listed in the Notice to Contractors section of the bid documents is a fixed price determined at the time of bid by the Department by using the same method as for the determination of the Period Price detailed below.

Period Price

Please note that, starting December 15, 2008, two sets of period prices will be posted each month on the MassHighway website at <http://www.mhd.state.ma.us/>. They will be labeled "New Asphalt Period Price Method" and "Old Asphalt Period Price Method".

New Asphalt Period Price Method

The "New Asphalt Period Price Method" is for contracts bid after December 15, 2008 and will show the Period Price of liquid asphalt for each monthly period as determined by MassHighway using the average selling price per standard ton of PG64-28 paving grade (primary binder classification) asphalt, FOB manufacturer's terminal, as listed under the "East Coast Market - New England, Boston, Massachusetts area" section of the Poten & Partners, Inc. "Asphalt Weekly Monitor". This average selling price is listed in the issue having a publication date of the second Friday of the month and will be posted as the Period Price for that month. MassHighway will post this Period Price on this website within two (2) business days following their receipt of the relevant issue of the "Asphalt Weekly Monitor". Poten and Partners has granted MassHighway the right to publish this specific asphalt price information sourced from the Asphalt Weekly Monitor.

Old Asphalt Period Price Method

The "Old Asphalt Period Price Method" Period Price will be for contracts bid on or before December 15, 2008 and will contain liquid asphalt prices as determined by the old or previous method. These prices will continue to be posted on MassHighway's website until all contracts using the "Old Asphalt Period Price Method" Period Price have been closed.

New and Old Asphalt Period Price Methods

The paragraphs below apply to both the New and the Old Asphalt Period Price Methods.

The Contract Price of the hot mix asphalt mixture will be paid under the respective item in the Contract. The price adjustment, as herein provided, upwards or downwards, will be made after the work has been performed, using the monthly period price for the month during which the work was performed.

The Price Adjustment applies only to the actual virgin liquid asphalt content in the mixture placed on the job in accordance with the Standard Specifications for Highways and Bridges, Division III, Section M3.11.03.

The Price Adjustment will be a separate payment item. It will be determined by multiplying the number of tons of hot mix asphalt mixtures placed during each monthly period times the liquid asphalt content percentage times the variance in price between Base Price and Period Price of liquid asphalt.

This Price Adjustment will be paid only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

**DOCUMENT 00812
SPECIAL PROVISIONS
MONTHLY PRICE ADJUSTMENT FOR DIESEL FUEL AND GASOLINE –
ENGLISH UNITS**

Revised: 09/26/2009

This monthly fuel price adjustment is inserted in this contract because the national and worldwide energy situation has made the future cost of fuel unpredictable. This adjustment will provide for either additional compensation to the Contractor or repayment to the Commonwealth, depending on an increase or decrease in the average price of diesel fuel or gasoline.

This adjustment will be based on fuel usage factors for various items of work developed by the Highway Research Board in Circular 158, dated July 1974. These factors will be multiplied by the quantities of work done in each item during each monthly period and further multiplied by the variance in price from the Base Price to the Period Price.

The Base Price of Diesel Fuel and Gasoline will be the price as indicated in the Massachusetts Highway Division (MassDOT) web site (<http://www.mass.gov/orgs/highway-division>) for the month in which the contract was bid, which includes State Tax.

The Period Price will be the average of prices charged to the State, including State Tax for the bulk purchases made during each month.

This adjustment will be effected only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

No adjustment will be paid for work done beyond the extended completion date of any contract.

Any adjustment (increase or decrease) to estimated quantities made to each item at the time of final payment will have the fuel price adjustment figured at the average period price for the entire term of the project for the difference of quantity.

The fuel price adjustment will apply only to the following items of work at the fuel factors shown:

ITEMS COVERED FUEL FACTORS

Excavation and Borrow Work:

	Diesel	Gasoline
All Items requiring excavation	0.29 Gallons / CY.	0.15 Gallons / CY

Surfacing Work:

All Items containing Hot Mix Asphalt	2.90 Gallons / Ton	Does Not Apply
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***** END OF DOCUMENT *****

DOCUMENT 00814

SPECIAL PROVISIONS
PRICE ADJUSTMENT FOR PORTLAND CEMENT CONCRETE MIXES

January 12, 2009

This provision applies to all projects using greater than 100 Cubic Yards (76 Cubic Meters) of Portland cement concrete containing Portland cement as stipulated in the Notice to Contractors section of the Bid Documents. This Price Adjustment will occur on a monthly basis.

The Price Adjustment will be based on the variance in price for the Portland cement component only from the Base Price to the Period Price. It shall not include transportation or other charges.

The Base Price of Portland cement on a project is a fixed price determined at the time of bid by the Department by using the same method as for the determination of the Period Price (see below) and found in the Notice to Contractors.

The Period Price of Portland cement will be determined by using the latest published price, in dollars per ton (U.S.), for Portland cement (Type I) quoted for Boston, U.S.A. in the Construction Economics section of *ENR Engineering News-Record* magazine or at the ENR website <http://www.enr.com> under Construction Economics. The Period Price will be posted on the MassHighway website the Wednesday immediately following the publishing of the monthly price in ENR, which is normally the first week of the month.

The Contract Price of the Portland cement concrete mix will be paid under the respective item in the Contract. The price adjustment, as herein provided, upwards or downwards, will be made after the work has been performed, using the monthly period price for the month during which the work was performed.

The price adjustment applies only to the actual Portland cement content in the mix placed on the job in accordance with the Standard Specifications for Highways and Bridges, Division III, Section M4.02.01. No adjustments will be made for any cement replacement materials such as fly ash or ground granulated blast furnace slag.

The Price Adjustment will be a separate payment item. It will be determined by multiplying the number of cubic yards of Portland cement concrete placed during each monthly period times the Portland cement content percentage times the variance in price between the Base Price and Period Price of Portland cement.

This Price Adjustment will be paid only if the variance from the Base Price is 5% or more for a monthly period. The complete adjustment will be paid in all cases with no deduction of the 5% from either upward or downward adjustments.

No Price Adjustment will be allowed beyond the Completion Date of this Contract, unless there is a Department-approved extension of time.

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 two (2) signs at the project site at the location directed. The Contractor shall maintain the signs, 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 signs 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 signs shall meet the following criteria:

¾" thick exterior high density overlay plywood

Signs shall be 5 feet wide by 3 feet high, mounted at least 4 feet above the ground

Signs shall be multi-colored and with font style and font size as directed by the Owner

Signs shall include graphic logo for the City of Cambridge, DPW's "The Works" logo, the Engineers, and the Contractor.

The lettering on the signs 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 the appendices, 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 Appendix 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.

ARTICLE 9 – INSURANCE REQUIREMENTS

- 9.1 Insurance requirements provided in Article 8 of Section 00800 “General Terms and Conditions” shall include the City of Cambridge, Kleinfelder, McMahon, Stantec, Toole, KMDG, Buia, and Irrigation Consulting, Inc.
- 9.2 Engineers providing professional design services to the Contractor are required to carry Professional Liability Insurance in the amount of at least \$1,000,000, unless otherwise specified, and meeting all requirements laid out in this Section and Section 00800 “General Terms and Conditions”.

ARTICLE 11 – QUANTITIES AND UNIT PRICES

The unit prices for each of the several items in the proposal of each Bidder shall include its prorated share of overhead, so that the sum of the products obtained by multiplying the quantity shown for each item by the unit price bid represents the total bid. Any Bid not conforming to this requirement may be rejected as informal. The special attention of all Bidders is called to this provision, should conditions make it necessary to revise the quantities, no limit will be fixed for such increased or decreased quantities nor extra compensation allowed, provided the net monetary value of such additive or subtractive changes in quantities of such items of work (i.e., difference in cost) shall not increase or decrease the original contract price by more than twenty-five percent (25%) except for work not covered in the Contract Documents as provided for in Section 00800, Article 11 CHANGES IN THE WORK.”

END OF SECTION 00825

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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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 Attachment III Ordinance Number 1329 (Dumpster Licenses)
 Attachment IV Massachusetts Diesel Retrofit Program
 Attachment V Excepts of Massachusetts General Laws

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 2019, 2020, and 2021 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 2019, October 2020, October 2021
MIT Spring Term Final Examination Period – May 2019, 2020, and 2021
MIT graduation – June 2019, 2020, and 2021
Harvard Spring Term Final Examination Period – May 2019, 2020, and 2021
Harvard graduation – June 2019, 2020, and 2021

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 and Engineer prior to commencement of the work and in accordance with the additional requirements specified herein, and approved by the Owner. The Contractor shall include cost loading, monthly payment requisitions and project status reporting requirements within the Schedule. 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 Somerville 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 Department of Transportation, Highway Division (MassDOT), 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, 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 removal and sidewalk maintenance and de-icing at the time of a snow event within the areas of work and as required for the work to proceed. 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 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 Professional Land Surveyor registered in the Commonwealth of 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 may be done within the limits of properties that are state-owned and/or 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 Inman Square Intersection Safety Improvement Project, 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 up to \$500per 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 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 – COMMUNITY AND STAKEHOLDER MEETINGS: The CONTRACTOR is required to attend at least six (6) community and/or stakeholder meetings held during working hours, or at night, for the purpose of informing the residents, businesses and other interested parties 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.

ARTICLE 60 – MASSACHUSETTS GENERAL LAWS: The following Massachusetts General Laws apply to the contract. The list is not meant to be all inclusive:

- M.G.L. c.30 s39F Payment to Subcontractor (See General Conditions 13.8.2)
- M.G.L. c.30 s39I Deviation from Plans and Specifications (See General Conditions 11.2.1)
- M.G.L. c.30 s39J No Arbitrary Decisions are Final (See General Conditions 16.6.3)
- M.G.L. c.30 s39L Construction of Work by Foreign Corporations
- M.G.L. c.30 s39M(b) Substitution of Equal Products (See General Conditions 5.13.1)
- M.G.L. c.30 s39N Differing Site Conditions (See General Conditions 16.4.1)
- M.G.L. c.30 s39O Equitable Adjustment for Delays (See General Conditions 12.3.6)
- M.G.L. c.30 s39P Decision on Interpretation of Specifications (See General Conditions 16.6.1)
- M.G.L. c.30 s39R Contractor's Records (See Special Conditions Article 47)
- M.G.L. c.149 s34 Limitations on Hours of Work (See General Conditions 5.5.4)

- M.G.L. c.149 s44J Advertising Invitations to Bid
- M.G.L. c.82 s40 Excavations; Notices; Penalties

END OF SECTION 00825A - SPECIAL CONDITIONS

(ATTACHMENTS I, II, III, IV, V TO SECTION 00825A FOLLOWS)

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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, (\$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.

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 Certified Arborist (MCA) and/or International Society of Arboriculture (ISA) 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 a 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 with 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 in complete.
2. The proper pruning (raise pruning) of low branches to a height no greater than fourteen feet (14") above the roadway and eight feet (8") 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 with the permission of the City Arborist shall execute the operation with sufficiently sharpened had tools and in such a fashion s 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.

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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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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 II

General Laws of Massachusetts – Part I – Title XIV Public Ways and Works – Chapter 82 – Section 40

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Attachment III
Ordinance Number 1329 (Dumpster Licenses)

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

DIESEL RETROFIT PROGRAM

The Department of Environmental Protection (“DEP”) has developed the Diesel Retrofit Program in response to increasing public health concerns with the emissions from diesel engines and vehicles.

Diesel Construction Equipment Standard

All diesel powered non-road construction equipment and vehicles greater than 50 brake horsepower which will be used in the performance of the work under the Contract (hereinafter “Diesel Construction Equipment”) must have the following pollution control device installed unless exempt as provided below:

1. Emission control technology verified by U.S. Environmental Protection Agency (“EPA”) or the California Air Resources Board (“CARB”) for use with non-road engines;
2. Emission control technology verified by EPA or CARB for use with on-road engines provided that such equipment is operated with diesel fuel that has no more than 15 parts per million sulfur content (i.e. Ultra Low Sulfur Diesel fuel); or
3. Emission control technology certified by the manufacturer that such technology meets or exceeds the emission reductions provided by on-road or off-road emission control technology verified by EPA or CARB, i.e. that a Diesel Oxidation Catalyst is achieving the following minimum emission reductions: particulate matter 20%; carbon monoxide 40%; volatile organic compounds 50%; or a Diesel Particulate Filter is achieving a minimum of 85% emission reductions for particulate matter.

Emission control devices, such as oxidation catalysts or particulate filters, shall be installed on the exhaust system side of the Diesel Construction Equipment. The Contractor shall be responsible to insure that the emissions control technology is operated, maintained, and serviced as recommended by the manufacturer.

For the latest up-to-date list of EPA verified-technologies, see:

<https://www.epa.gov/verified-diesel-tech/verified-technologies-list-clean-diesel>

For the latest up-to-date list of CARB verified technologies, see:

<https://www.arb.ca.gov/diesel/verdev/vt/cvt.htm>

Exemptions

The following Diesel Construction Equipment shall be exempt from the standard above. The Contractor shall include such Diesel Construction Equipment in the required recordkeeping:

1. Diesel Construction Equipment not owned by the Contractor and used in the performance of the work under this Contract for 30 calendar days (cumulative days but not necessarily consecutive) or less;
2. Unless otherwise exempt, additional Diesel Construction Equipment originally not anticipated to be used under the Contract or used as permanent replacement after the work under the Contract has commenced, for 15 calendars days from the date such Diesel Construction Equipment is brought on site;

3. Diesel Construction Equipment with an engine that meets the EPA particulate matter (PM) Tier emission standards in effect at the start of the Contract for non-road diesel engines for the applicable engine power group_(e.g., as of January 1, 2009, a piece of Diesel Construction Equipment with a Tier 3 engine is exempt from meeting the standard until the piece of Diesel Construction Equipment is available with a Tier 4 engine) provided that if such emissions standards are superseded during the Contract then such Diesel Construction Equipment must be retrofitted in accordance with the standards above prior to the end of the Contract;
4. A large crane (e.g. a sky crane or link belt crane which is responsible for critical lift operations) if such device would adversely affect the operation of the crane provided the Contractor submits to the municipality's project engineer written technical justification documenting the adverse impact on operation; and
5. Diesel Construction Equipment that the project engineer has determined is necessary to control a compelling emergency including but not limited to, the need for rescue vehicles or other equipment to prevent harm to human beings or additional equipment required to address a catastrophic emergency such as structure collapse or imminent collapse. After the compelling emergency is controlled, such non-compliant equipment must be removed from the Contract site and may not be used in further performance of the work under this Contract. Meeting Contract deadlines is not a compelling emergency.

Contractor Certification

Each bidder shall submit as part of its bid, the Statement of Intent to Comply. Within 10 days of being notified that it has been awarded a contract, the bidder and each of its Contractors and Subcontractors shall submit a Diesel Retrofit Program Contractor Certification. Each such Certification shall contain the following information for each piece of Diesel Construction Equipment:

1. Contractor or Subcontractor name;
2. Equipment type, make, model;
3. Vehicle Identification Number or VIN;
4. Engine model and year of manufacture;
5. Engine HP rating;
6. Emission Control Device (ECD) type (Diesel Oxidation Catalyst or Diesel Particulate Filter);
7. ECD make, model, and manufacturer;
8. ECD EPA or CARB Verification Number or manufacturer's certification that the DOC or DPF meets or exceeds emission reductions provided by similar emission control technology verified by EPA or CARB;
9. ECD installation date;
10. Type of fuel to be used; and
11. Whether the equipment is owned or rented.

Recordkeeping

Each Contractor and Subcontractor shall maintain detailed records of all Diesel Construction Equipment used under the Contract, including the dates and duration times the Diesel

Construction Equipment is used at the Contract site. Records shall be available for inspection by DEP. Each Contractor and Subcontractor shall notify DEP within 48 hours of any new Diesel Construction Equipment brought onto the Contract site.

For Diesel Construction Equipment that has an emissions control device with a manufacturer's certification, the Contractor shall maintain records of all supporting emissions test data and test procedures. If upon review the emissions reductions are not supported by the test data and test procedures, then the emissions control device may need to be replaced with a compliant retrofit device.

The City shall require each Contractor and Subcontractor to submit the Diesel Retrofit Program Contractor Certification to DEP and the City prior to commencing work on the Project. The City shall not allow any Contractor or Subcontractor to commence work at the Project site prior to submitting such Certification.

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Attachment IV

Massachusetts Diesel Retrofit Program

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Attachment V

Excerpts from Massachusetts General Laws

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NOTICE: - This is NOT the official version of the Massachusetts General Laws (MGL). While reasonable efforts have been made to assure the accuracy of the data provided, do not rely on this information without first checking an official edition of the MGL.

If you are in need of legal advice or counsel, consult an attorney.

MASSACHUSETTS GENERAL LAWS

(Updated to July 12, 2013)

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CHAPTER 30. GENERAL PROVISIONS RELATIVE TO STATE DEPARTMENTS, COMMISSIONS, OFFICERS AND EMPLOYEES

Chapter 30: Section 38A Price adjustment clause

Contracts for road, bridge, water, and sewer projects awarded as a result of a proposal or invitation for bids under chapter 7C, section 11C of Chapter 25A, section 39M of this chapter and sections 44A to 44H, inclusive, of chapter 149 shall include a price adjustment clause for each of the following materials: fuel, both diesel and gasoline; asphalt; concrete; and steel. A base price for each material shall be set by the awarding authority or agency and shall be included in the bid documents at the time the project is advertised. The awarding authority or agency shall also identify in the bid documents the price index to be used for each material. The price adjustment clause shall provided for a contract adjustment to be made on a monthly basis when the monthly cost change exceeds plus or minus 5 per cent.

Chapter 30: Section 39F Construction contracts; assignment and subrogation; subcontractor defined; enforcement of claim for direct payment; deposit, reduction of disputed amounts

Section 39F. (1) Every contract awarded pursuant to sections forty-four A to L, inclusive, of chapter one hundred and forty-nine shall contain the following subparagraphs (a) through (i) and every contract awarded pursuant to section thirty-nine M of chapter thirty shall contain the following subparagraphs (a) through (h) and in each case those subparagraphs shall be binding between the general contractor and each subcontractor.

(a) Forthwith after the general contractor receives payment on account of a periodic estimate, the general 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 general contractor.

(b) Not later than the sixty-fifth day after each subcontractor substantially completes his work in accordance with the plans and specifications, the entire balance due under the subcontract less amounts retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, shall be due the subcontractor; and the awarding authority shall pay that amount to the general contractor. The general contractor shall forthwith pay to the subcontractor the full amount received from the awarding authority less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the subcontractor by the general contractor.

(c) Each payment made by the awarding authority to the general contractor pursuant to subparagraphs (a) and (b) of this paragraph for the labor performed and the materials

furnished by a subcontractor shall be made to the general contractor for the account of that subcontractor; and the awarding authority shall take reasonable steps to compel the general contractor to make each such payment to each such subcontractor. If the awarding authority has received a demand for direct payment from a subcontractor for any amount which has already been included in a payment to the general contractor or which is to be included in a payment to the general contractor for payment to the subcontractor as provided in subparagraphs (a) and (b), the awarding authority shall act upon the demand as provided in this section.

(d) If, within seventy days after the subcontractor has substantially completed the subcontract work, the subcontractor has not received from the general contractor the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount retained by the awarding authority as the estimated cost of completing the incomplete and unsatisfactory items of work, the subcontractor may demand direct payment of that balance from the awarding authority. The demand shall be by a sworn statement delivered to or sent by certified mail to the awarding authority, and a copy shall be delivered to or sent by certified mail to the general contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the subcontract work shall be valid even if delivered or mailed prior to the seventieth day after the subcontractor has substantially completed the subcontract work. Within ten days after the subcontractor has delivered or so mailed the demand to the awarding authority and delivered or so mailed a copy to the general contractor, the general contractor may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the awarding authority and a copy shall be delivered to or sent by certified mail to the subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor and of the amount due for each claim made by the general contractor against the subcontractor.

(e) Within fifteen days after receipt of the demand by the awarding authority, but in no event prior to the seventieth day after substantial completion of the subcontract work, the awarding authority shall make direct payment to the subcontractor of the balance due under the subcontract including any amount due for extra labor and materials furnished to the general contractor, less any amount (i) retained by the awarding authority as the estimated cost of completing the incomplete or unsatisfactory items of work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the general contractor in the sworn reply; provided, that the awarding authority 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 subparagraph (d). The awarding authority 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 subparagraph.

(f) The awarding authority shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (e) in an interest-bearing joint account in the names of the general contractor and the subcontractor in a bank in Massachusetts selected by the awarding authority or agreed upon by the general contractor and the subcontractor and shall notify the general 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 general contractor and the subcontractor or as determined by decree of a court of competent jurisdiction.

(g) All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to subparagraph (f) shall be made out of amounts payable to the general contractor at the time of receipt of a demand for direct payment from a subcontractor and out of amounts which later become payable to the general contractor and in the order of receipt of such demands from subcontractors. All direct payments shall discharge the obligation of the awarding authority to the general contractor to the extent of such payment.

(h) The awarding authority shall deduct from payments to a general contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (f), are sufficient to satisfy all unpaid balances of demands for direct payment received from subcontractors. All such amounts shall be earmarked for such direct payments, and the subcontractors shall have a right in such deductions prior to any claims against such amounts by creditors of the general contractor.

(i) If the subcontractor does not receive payment as provided in subparagraph (a) or if the general contractor does not submit a periodic estimate for the value of the labor or materials performed or furnished by the subcontractor and the subcontractor does not receive payment for same when due less the deductions provided for in subparagraph (a), the subcontractor may demand direct payment by following the procedure in subparagraph (d) and the general contractor may file a sworn reply as provided in that same subparagraph. A demand made after the first day of the month following that for which the subcontractor performed or furnished the labor and materials for which the subcontractor seeks payment shall be valid even if delivered or mailed prior to the time payment was due on a periodic estimate from the general contractor. Thereafter the awarding authority shall proceed as provided in subparagraph (e), (f), (g) and (h).

(2) Any assignment by a subcontractor of the rights under this section to a surety company furnishing a bond under the provisions of section twenty-nine of chapter one hundred forty-nine 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 awarding authority or which are on deposit pursuant to subparagraph (f) of paragraph (1) 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) "Subcontractor" as used in this section (i) for contracts awarded as provided in sections forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall mean a person who files a sub-bid and receives a subcontract as a result of that filed sub-bid or who is approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, (ii) for contracts awarded as provided in paragraph (a) of section thirty-nine M of chapter thirty shall mean a person approved by the awarding authority in writing as a person performing labor or both performing labor and furnishing materials pursuant to a contract with the general contractor, and (iii) for contracts with the commonwealth not awarded as provided in forty-four A to forty-four H, inclusive, of chapter one hundred forty-nine shall also mean a person contracting with the general contractor to supply materials used or employed in a public works project for a price in excess of five thousand dollars.

(4) A general contractor or a subcontractor shall enforce a claim to any portion of the amount of a demand for direct payment deposited as provided in subparagraph (f) of paragraph 1 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 subparagraph (f) of paragraph 1 by a petition in equity in the superior court against the awarding authority and the general 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. Sections fifty-nine and fifty-nine B of chapter two hundred thirty-one 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 sections fifty-nine and fifty-nine B 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 general contractor are available for direct payment shall have a right to file a petition in court of equity against the awarding authority claiming a demand for direct payment is premature and such subcontractor must file the petition before the awarding authority has made a direct payment to the subcontractor and has made a deposit of the disputed portion as provided in part (iii) of subparagraph (e) and in subparagraph (f) of paragraph (1).

(5) 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 general contractor, reduce by the amount of any deposit of a disputed amount by the awarding authority as provided in part

(iii) of subparagraph (e) and in subparagraph (f) of paragraph (1) any amount held under a trustee writ or pursuant to a restraining order or injunction.

CHAPTER 30. GENERAL PROVISIONS RELATIVE TO STATE DEPARTMENTS, COMMISSIONS, OFFICERS AND EMPLOYEES

Chapter 30: Section 39I Deviations from plans and specifications

Section 39I. Every contractor having a contract for the construction, alteration, maintenance, repair or demolition of, or addition to, any public building or public works for the commonwealth, or of any political subdivision thereof, shall perform all the work required by such contract in conformity with the plans and specifications contained therein. No wilful and substantial deviation from said plans and specifications shall be made unless authorized in writing by the awarding authority or by the engineer or architect in charge of the work who is duly authorized by the awarding authority to approve such deviations. In order to avoid delays in the prosecution of the work required by such contract such deviation from the plans or specifications may be authorized by a written order of the awarding authority or such engineer or architect so authorized to approve such deviation. Within thirty days thereafter, such written order shall be confirmed by a certificate of the awarding authority 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 contracting agency and the contractor and the amount in dollars of said adjustment; and (4) that the deviation is in the best interest of the contracting authority.

Such certificate shall be signed under the penalties of perjury and shall be a permanent part of the file record of the work contracted for.

Whoever violates any provision of this section willfully and with intent to defraud shall be punished by a fine of not more than five thousand dollars or by imprisonment for not more than six months, or both.

**CHAPTER 30. GENERAL PROVISIONS RELATIVE TO STATE DEPARTMENTS,
COMMISSIONS, OFFICERS AND EMPLOYEES**

**Chapter 30: Section 39J Public construction contracts; effect of decisions of
contracting body or administrative board**

Section 39J. Notwithstanding any contrary provision of any contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building or public works by the commonwealth, or by any county, city, town, district, board, commission or other public body, when the amount of the contract is more than five thousand dollars in the case of the commonwealth and more than two thousand dollars in the case of any county, city, town, district, board, commission or other public body, a decision, by the contracting body or by any administrative board, official or agency, or by any architect or engineer, on a dispute, whether of fact or of law, arising under said contract shall not be final or conclusive if such decision is made in bad faith, fraudulently, capriciously, or arbitrarily is unsupported by substantial evidence, or is based upon error of law.

**CHAPTER 30. GENERAL PROVISIONS RELATIVE TO STATE DEPARTMENTS,
COMMISSIONS, OFFICERS AND EMPLOYEES**

**Chapter 30: Section 39L Public construction work by foreign corporations;
restrictions and reports**

Section 39L. The commonwealth and every county, city, town, district, board, commission or other public body which, as the awarding authority, requests proposals, bids or sub-bids for any work in the construction, reconstruction, alteration, remodeling, repair or demolition of any public building or other public works (1) shall not enter into a contract for the work with, and shall not approve as a subcontractor furnishing labor and materials for a part of the work, a foreign corporation which has not filed with the awarding authority a certificate of the state secretary stating that the corporation has complied with requirements of section 15.03 of subdivision A of Part 15 of chapter 156D and the date of compliance, and further has filed all annual reports required by section 16.22 of subdivision B of Part 16 of said chapter 156D, 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.

CHAPTER 30. GENERAL PROVISIONS RELATIVE TO STATE DEPARTMENTS, COMMISSIONS, OFFICERS AND EMPLOYEES

Chapter 30: Section 39M Contracts for construction and materials; manner of awarding

Section 39M. (a) Every contract for the construction, reconstruction, alteration, remodeling or repair of any public work, or for the purchase of any material, as hereinafter defined, by the commonwealth, or political subdivision thereof, or by any county, city, town, district, or housing authority, and estimated by the awarding authority to cost more than ten thousand dollars, and every contract for the construction, reconstruction, installation, demolition, maintenance or repair of any building by a public agency, as defined by subsection one of section forty-four A of chapter one hundred and forty-nine, estimated to cost more than \$25,000 but not more than \$100,000, shall be awarded to the lowest responsible and eligible bidder on the basis of competitive bids publicly opened and read by such awarding authority forthwith upon expiration of the time for the filing thereof; provided, however, that such awarding authority may reject any and all bids, if it is in the public interest to do so. Every bid for such contract shall be accompanied by a bid deposit in the form of a bid bond, or cash, or a certified check on, or a treasurer's or cashier's check issued by, a responsible bank or trust company, payable to the awarding authority. The amount of such bid deposit shall be five per cent of the value of the bid. Any person submitting a bid under this section shall, on such bid, certify as follows:

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

(Name of person signing bid)

(Company)

This paragraph shall not apply to the award of any contract subject to the provisions of sections forty-four A to forty-four J, inclusive, of chapter one hundred and forty-nine and every such contract shall continue to be awarded as provided therein. In cases of extreme emergency caused by enemy attack, sabotage or other such hostile actions or resulting from an imminent security threat explosion, fire, flood, earthquake, hurricane, tornado or other such catastrophe, an awarding authority may, without competitive bids and notwithstanding any general or specific law, award contracts otherwise subject to this paragraph to perform work and to purchase or rent materials and equipment, all as may be necessary for temporary repair and restoration to service of any and all public work in order to preserve the health and safety of persons or property; provided, that this exception shall not apply to any permanent reconstruction, alteration, remodeling or repair of any public work.

(b) Specifications for such contracts, and specifications for contracts awarded pursuant to the provisions of said sections forty-four A to forty-four L of said chapter one hundred and forty-nine, shall be written to provide for full competition for each item of material to be furnished under the contract; except, however, that said specifications may be otherwise written for sound reasons in the public interest stated in writing in the public records of the awarding authority or promptly given in writing by the awarding authority to anyone making a written request therefor, in either instance such writing to be prepared after reasonable investigation. Every such contract shall provide that an item equal to that named or described in the said specifications may be furnished; and an item shall be considered equal to the item so named or described if, in the opinion of the awarding authority: (1) it is at least equal in quality, durability, appearance, strength and design, (2) it will perform at least equally the function imposed by the general design for the public work being contracted for or the material being purchased, and (3) it conforms substantially, even with deviations, to the detailed requirements for the item in the said specifications. For each item of material the specifications shall provide for either a minimum of three named brands of material or a description of material which can be met by a minimum of three manufacturers or producers, and for the equal of any one of said name or described materials.

(c) The term "lowest responsible and eligible bidder" shall mean the bidder: (1) whose bid is the lowest of those bidders possessing the skill, ability and integrity necessary for the faithful performance of the work; (2) who shall certify, 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; (3) 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 for each employee; (4) who, where the provisions of section 8B of chapter 29 apply, shall have been determined to be qualified thereunder; and (5) 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; provided further, that if there is more than 1 surety company, the surety companies shall be jointly and severally liable.

(d) The provisions of this section shall not apply (1) to the extent that they prevent the approval of such specifications by any contributing federal agency, (2) to materials purchased under specifications of the state department of highways at prices established by the said department pursuant to advertisement and bidding in connection with work to be performed under the provisions of chapter eighty-one or chapter ninety, (3) to any transaction between the commonwealth and any of its political subdivisions or between the commonwealth and any public service corporation, and (4) to any contract of not more than twenty-five thousand dollars awarded by a governmental body, as defined by section two of chapter thirty B, in accordance with the provisions of section five of said

chapter thirty B; and (5) to any contract solely for the purchase of material awarded by a governmental body, as defined by section 2 of chapter 30B, in accordance with section 5 of said chapter 30B.

(e) The word "material" as used in this section shall mean and include any article, assembly, system, or any component part thereof.

**CHAPTER 30. GENERAL PROVISIONS RELATIVE TO STATE DEPARTMENTS,
COMMISSIONS, OFFICERS AND EMPLOYEES**

Chapter 30: Section 39N Construction contracts; equitable adjustment in contract price for differing subsurface or latent physical conditions

Section 39N. Every contract subject to section forty-four A of chapter one hundred and forty-nine or subject to section thirty-nine M of chapter thirty shall contain the following paragraph in its entirety and an awarding authority may adopt reasonable rules or regulations in conformity with that paragraph concerning the filing, investigation and settlement of such claims:

If, during the progress of the work, the contractor or the awarding authority discovers that the actual subsurface or latent physical conditions encountered at the site differ substantially or materially from those shown on the plans or indicated in the contract documents either the contractor or the contracting authority may request an equitable adjustment in the contract price 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 contracting authority shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans 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 plans 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 contracting authority shall make an equitable adjustment in the contract price and the contract shall be modified in writing accordingly.

CHAPTER 30. GENERAL PROVISIONS RELATIVE TO STATE DEPARTMENTS, COMMISSIONS, OFFICERS AND EMPLOYEES

Chapter 30: Section 39O Contracts for construction and materials; suspension, delay or interruption due to order of awarding authority; adjustment in contract price; written claim

Section 39O. Every contract subject to the provisions of section thirty-nine M of this chapter or subject to section forty-four A of chapter one hundred forty-nine shall contain the following provisions (a) and (b) in their entirety and, in the event a suspension, delay, interruption or failure to act of the awarding authority increases the cost of performance to any subcontractor, that subcontractor shall have the same rights against the general contractor for payment for an increase in the cost of his performance as provisions (a) and (b) give the general contractor against the awarding authority, but nothing in provisions (a) and (b) shall in any way change, modify or alter any other rights which the general contractor or the subcontractor may have against each other.

(a) The awarding authority may order the general 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 awarding authority; provided however, that if there is a suspension, delay or interruption for fifteen days or more or due to a failure of the awarding authority to act within the time specified in this contract, the awarding authority shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the general contractor on such increase; and provided further, that the awarding authority shall not make any 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 general contractor must submit the amount of a claim under provision (a) to the awarding authority 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 awarding authority shall not approve any costs in the claim incurred more than twenty days before the general contractor notified the awarding authority in writing of the act or failure to act involved in the claim.

**CHAPTER 30. GENERAL PROVISIONS RELATIVE TO STATE DEPARTMENTS,
COMMISSIONS, OFFICERS AND EMPLOYEES**

**Chapter 30: Section 39P Contracts for construction and materials; awarding
authority's decisions on interpretation of specifications, etc.; time limit; notice**

Section 39P. Every contract subject to section thirty-nine M of this chapter or section forty-four A of chapter one hundred forty-nine which requires the awarding authority, any official, its architect or engineer to make a decision on interpretation of the specifications, approval of equipment, material or any other approval, or progress of the work, shall require that the decision be made promptly and, in any event, no later than thirty days after the written submission for decision; but if such decision requires extended investigation and study, the awarding authority, the official, architect or engineer shall, within thirty 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.

**CHAPTER 30. GENERAL PROVISIONS RELATIVE TO STATE DEPARTMENTS,
COMMISSIONS, OFFICERS AND EMPLOYEES**

**Chapter 30: Section 39R Definitions; contract provisions; management and
financial statements; enforcement**

Section 39R. (a) The words defined herein shall have the meaning stated below whenever they appear in this section:

(1) "Contractor" means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded a contract pursuant to sections thirty-eight A 1/2 to thirty-eight O, inclusive, of chapter seven and any contract awarded or executed pursuant to section eleven C of chapter twenty-five A, section thirty-nine M of chapter thirty, or sections forty-four A to forty-four H, inclusive, of chapter one hundred and forty-nine, which is for an amount or estimated amount greater than one hundred thousand dollars.

(2) "Contract" means any contract awarded or executed pursuant to sections thirty-eight A 1/2 to thirty-eight O, inclusive, of chapter seven and any contract awarded or executed pursuant to section eleven C of chapter twenty-five A, section thirty-nine M of chapter thirty, or sections forty-four A through forty-four H, inclusive, of chapter one hundred and forty-nine, which is for amount or estimated amount greater than one hundred thousand dollars.

(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.

(4) "Independent Certified Public Accountant" 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 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 awarding authority.

(5) "Audit", when used in regard to financial statements, 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.

(6) "Accountant's Report", when used in regard to financial statements, means a document in which an independent certified public accountant indicates the scope of the audit which he has made and sets forth his opinion regarding the financial statements taken as a whole with a 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 a 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.

(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.

(8) Accounting terms, unless otherwise defined herein, shall have a meaning in accordance with generally accepted accounting principles and auditing standards.

(b) Subsection (a)(2) hereof notwithstanding, every agreement or contract awarded or executed pursuant to sections thirty-eight A 1/2 to thirty-eight O, inclusive, of chapter seven, or eleven C of chapter twenty-five A, and pursuant to section thirty-nine M of chapter thirty or to section forty-four A through H, inclusive, of chapter one hundred and forty-nine, shall provide that:

(1) 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 contractor, and

(2) until the expiration of six years after final payment, the office of inspector general, and the commissioner of capital asset management and maintenance shall have the right to examine any books, documents, papers or records of the contractor or of his subcontractors that directly pertain to, and involve transactions relating to, the contractor or his subcontractors, and

(3) if the agreement is a contract as defined herein, the contractor shall describe any change in the method of maintaining records or recording transactions which materially affect any statements filed with the awarding authority, including in his 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

(4) if the agreement is a contract as defined herein, the contractor has filed a statement of management on internal accounting controls as set forth in paragraph (c) below prior to the execution of the contract, and

(5) if the agreement is a contract as defined herein, the contractor has filed prior to the execution of the contracts and will continue to file annually, an audited financial statement for the most recent completed fiscal year as set forth in paragraph (d) below.

(c) Every contractor awarded a contract shall file with the awarding authority a statement of management as to whether the system of internal accounting controls of the contractor and its subsidiaries reasonably assures that:

(1) transactions are executed in accordance with management's general and specific authorization;

(2) transactions are recorded as necessary

i. to permit preparation of financial statements in conformity with generally accepted accounting principles, and

ii. to maintain accountability for assets;

(3) access to assets is permitted only in accordance with management's general or specific authorization; and

(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.

Every contractor awarded a contract shall also file with the awarding authority a statement prepared and signed by an independent certified public accountant, stating that he has examined the statement of management on internal accounting controls, and expressing an opinion as to

(1) whether the representations of management in response to this paragraph and paragraph (b) above are consistent with the result of management's evaluation of the system of internal accounting controls; and

(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.

(d) Every contractor awarded a contract by the commonwealth or by any political subdivision thereof shall annually file with the commissioner of capital asset management and maintenance 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 awarding authority upon request.

(e) The office of inspector general, the commissioner of capital asset management and maintenance and any other awarding authority shall enforce the provisions of this section. The commissioner of capital asset management and maintenance may after providing an opportunity for the inspector general and other interested parties to comment, promulgate pursuant to the provisions of chapter thirty A such rules, regulations and guidelines as are necessary to effectuate the purposes of this section. Such rules, regulations and guidelines may be applicable to all awarding authorities. A contractor's failure to satisfy any of the requirements of this section may be grounds for debarment pursuant to section forty-four C of chapter one hundred and forty-nine.

(f) Records and statements required to be made, kept or filed under the provisions of this section shall not be public records as defined in section seven of chapter four and shall not be open to public inspection; provided, however, that such records and statements shall be made available pursuant to the provisions of clause (2) of paragraph (b).

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work to be done under this contract consists of the installation of new storm drain pipe and structures; the replacement of water main; pedestrian and bicycle facility improvements; surface improvements including curb, sidewalk and roadway reconstruction; and landscape and streetscape improvements.
- B. The Work includes, but is not limited to, installation of the following.
 - 1. Major subsurface components including approximately 700 linear feet of 6-inch to 48-inch diameter PVC, RCP and DI storm drains, storm drain manholes, and catch basins; 800 linear feet of 6-inch underdrain; 850 linear feet of 6-inch, 8-inch and 12-inch DI water main, hydrants and replacement of water services; restoration of all disturbed areas; and test pits as shown on the plans and as directed by the Engineer.
 - 2. Major surface restoration components including roadway restoration of approximately 1,700 linear feet of roadway and sidewalks conforming to the latest MA AAB and ADA rules and regulations; full depth roadway construction; asphalt excavation by cold planer; pavement overlay; granite curbing; concrete sidewalk reconstruction; existing tree protection and maintenance; pavement markings; signage installation; traffic, pedestrian and bicycle signal installation including mast arms; and lighting and lighting conduit installation.
 - 3. Tree protection and maintenance; tree pruning; tree pit preparation and planting of street trees.
 - 4. Approximately 1,000 square feet of hardscape and landscape pedestrian plaza. Hardscape includes pavers, granite and wooden seating, landscape curb, lighting, and public artwork. Landscape includes installation of specialty soils, irrigation, and tree, shrub and groundcover plantings.
- C. 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. Tree protection, pruning and maintenance.
 - 2. Coordination with public and private utilities for the relocation and adjustment of their facilities as required.

3. Replacement of existing water mains.
 4. Installation of PVC, RCP and DI storm drains with related manholes.
 5. Demolition and abandonment of existing structures and pipes.
 6. Vibration monitoring as directed.
 7. Disposal of excess geotechnically; analytically; and logistically unsuitable excavated material.
 8. Reuse of 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.
 9. Remove and reset or furnish and install new granite curb; cold planing and overlay paving; trench pavement restoration; and installation of new cement concrete sidewalks, driveway reconstruction and pedestrian ramps conformed to the latest MA AAB rules and regulations and to the latest ADA standards for accessible design.
 10. Grading and surface restoration.
 11. Full depth pavement construction and installation of pavement markings.
 12. Installation of new street signs.
 13. Installation of traffic signals and conduit.
 14. Installation of lighting fixtures and conduit.
 15. Installation of hardscape including pavers, granite and wooden seating, landscape curb, lighting, and public artwork.
 16. Installation of specialty soils, irrigation, and tree, shrub and groundcover plantings.
- D. 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.
- E. 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.

- F. 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.
- G. 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

Refer to Specification Section 01063 for additional project sequencing requirements.

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 Geotechnical Instrumentation and Monitoring
- D. Establish baseline Sedimentation and Erosion Control and Tree Protection
- E. Mobilization
- F. Tree pruning and establish tree protection.
- G. Establish advance warning Traffic Management
- H. Layout of site work and survey control
- 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.

1.3 CONSTRUCTION COORDINATION WITH ADJACENT WORK

- A. Construction shall be coordinated with adjacent projects within the City of Cambridge.
- B. Construction shall be coordinated with adjacent projects within the City of Somerville.
- C. Contractor shall attend all City of Cambridge Utility Coordination meetings. Meetings typically occur on Mondays at 9:00 a.m. at the City of Cambridge Public Library at 449 Broadway, Lecture Hall (L2), between April and November.
- D. Coordination is considered incidental to the project, no additional payment will be authorized.

1.4 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. Refer to Specification Section 01200 for additional utility coordination information and requirements.

1.5 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.

1.6 HOURS OF WORK

- A. The hours of work shall be Monday through Friday, 7:00 a.m. – 4:00 p.m. excluding Saturdays and Sundays and the City of Cambridge and Cambridge Department of Public Works Holidays.

- B. During non-work hours (4:00 p.m. – 7:00 a.m. weekdays; weekends and holidays), 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.

1.7 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. Contractors equipment and materials shall not block hydrants or emergency vehicle access. Equipment stored after hours shall be at least 25 feet away from the intersections so that large emergency response vehicles may access all properties within the Contract area.
- 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.
- D. The Contractor shall remove all equipment and materials, provide full sidewalk and street access, and sweep clean the project area at the following locations and durations:
1. On Cambridge Street between Springfield Street and Prospect Street in advance of and through the duration of the "Inman Eats and Crafts" fair typically held the Sunday prior to Memorial Day weekend.
 2. On Hampshire Street and Cambridge Street in advance and through the duration of the Freedom Run on Sunday, June 9th.
- E. The City of Cambridge does not provide general parking for private vehicles that belong to contractors working in or upon the City of Cambridge. As a condition of construction permits, the Contractor will be required to manage

employee parking ensuring personal vehicles are parked off-site. Note that overtime parking at City meters, and/or parking in Residential Permit parking spaces without a permit, will not be tolerated. Repeated violations may result in loss of project permits.

1.8 LIST OF DRAWINGS

- A. The location, general characteristics, and principal details of the work are indicated on a set of drawings entitled "Inman Square Intersection Safety Improvement 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, 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 and water main 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 weekly and bi-weekly construction schedule projections and updates.
- q. Fulfilling all reporting requirements.
- r. 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 Smaller than 15-in Diameter.
- w. Demolition and Removal of Pipe Smaller than 15-in Diameter.
- x. Permanent Masonry Plugs and Bulkheads for Pipe Abandonment smaller than 15-in Diameter.
- y. CDF for pipe abandonment for Pipe Smaller than 15-in Diameter.
- 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, trash receptacles, 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. As-built drawings.
- 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, as described in Section 01400 – QUALITY CONTROL.

3. Include a revised 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.
- D. Contractor to provide a full onsite project manager for the duration of the project. Refer to Specifications – Statement of Bidder's Qualifications for project manager experience requirements.
- E. Coordination is considered incidental to the project, no additional payment will be authorized.
- F. Construction shall be coordinated with adjacent projects within the City of Cambridge.
- G. Contractor shall attend all City of Cambridge Utility Coordination meetings. Meetings typically occur on Mondays at 9:00 a.m. at the City of Cambridge Public Library at 449 Broadway, between April and November.

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.
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
 - 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

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 four (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, Cambridge Traffic and Parking Department, Somerville Engineering Department, Somerville Department of Public Works, Somerville Fire Department, Somerville Police Department, Somerville Water Department, Massachusetts Water Resource Authority, Massachusetts Department of Environmental Protection, Department of Conservation and Recreation, 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. Permit fees will be waived for permits administered by the Cambridge Department of Public Works and Cambridge Traffic and Parking Department.

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 and complying with include, but are not limited to, the following:
 - 1. Excavation Permit
 - 2. Street Obstruction Permit

3. Sidewalk Obstruction Permit
 4. Street Closing Permit
 5. Curb Cut Permit
 6. Traffic Management Plans including Detours
 7. Pedestrian Management Plans
 8. 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.
 9. Noise Variance
 - a. For work outside regular hours of construction. Regular hours of construction are Monday through Friday from 7:00 am to 6:00 pm and Saturday 9:00 am to 6:00 pm.
- C. At a minimum, the Somerville Department of Public Works and Somerville Engineering Department permits that the Contractor shall be responsible for obtaining and complying with include, but are not limited to, the following:
- a. Street/sidewalk Occupancy Permit
 - b. Trench Permit
 - c. Curb Cut Permit
 - d. Traffic Management Plans
 - e. Pedestrian Management Plans
- D. At a minimum, the other Permits the Contractor shall be responsible for obtaining, paying for, and complying with include, but are not limited to, the

following:

- NPDES Dewatering General Permit
 - MWRA Dewatering Permit
- E. 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.
- F. The Contractor shall be responsible for obtaining, paying for and complying with MassDEP and City of Cambridge Backflow Prevention Permits.
- G. The Contractor is solely responsible for the implementation of the permit requirements and shall include as such in the Bid.
- H. The Contractor is solely responsible for any punitive action resulting from any violation of the permit.
- I. Actual permits, issued by the respective agencies will be considered part of this Contract.
- J. The Contractor shall, at a minimum, include compliance with the provisions and requirements of a typical NPDES Construction Dewatering Discharge General Permit and the MWRA dewatering 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 01063

SEQUENCING OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies construction sequencing requirements for the following work:
 - 1. General sequencing requirements
 - 2. Porous Pavement Installation
 - 3. Coordination with abutting businesses and residences

1.2 SUBMITTALS

- A. The Contractor or its subcontractor shall be responsible for submitting sequencing plans for the construction activities described in Section 1.1 of this section and outlined in Part 3 below. Each plan shall describe sequence of activities required to complete work, indicate duration and schedule of work; indicate work zones and equipment used to complete work; provide traffic and pedestrian management description and plans, including abutter access, for each activity.

1.3 RELATED SECTIONS

- A. Specification Section 00020 – INVITATION TO BID
- B. Specification Section 01010 – SUMMARY OF WORK
- C. Specification Section 01570 – MAINTENANCE AND PROTECTION OF TRAFFIC
- D. Specification Section 02100 – SITE PREPARATION AND TREE PRUNING
- E. Specification Section 02500 – PAVING AND SURFACING
- F. Specification Section 02510 – HOT MIX ASPHALT POROUS PAVING
- G. Specification Section 02524 – CURBS, WALKS AND DRIVEWAYS

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 GENERAL SEQUENCING REQUIREMENTS

- A. The Contractor shall sequence the work with the following general requirements;
1. Tree pruning and installation of tree protection.
 2. Test pits indicated in the Contract Drawings or as otherwise required by the Engineer shall be performed prior to starting subsurface work on a street.
 3. Contractor shall coordinate with utility companies for required relocations and structure adjustments. Refer to U-sheets for required relocations and/or test pits required to confirm relocations.
 4. Contractor to complete roadway and sidewalk construction following the phasing plans included on sheets C-27 through C-28 of the Plans, or submit alternate phasing plans for review and approval by the Engineer and Owner.
 - i. Provide 30-foot minimum temporary road width, including 10-foot vehicle lanes and 5-foot bicycle lanes whenever possible.
 - ii. Maintain or install working vehicle, bicycle and pedestrian signals at all times. Temporary signals, if approved by the Engineer and Owner, may be utilized at no additional cost to the Owner.
 5. Full depth roadway construction and installation of base pavement shall be performed prior to installation of adjacent curb and sidewalk.
 6. It is understood that final placement of streetscape furnishings and plantings, and other similar above-grade finish work may occur subsequent to the initial sidewalk zone work described above.
- B. It is a goal of this project to minimize both the number and duration of disruptions to sidewalks in the project area. To that end, the Contractor's proposed sequence and schedule shall demonstrate that to the maximum extent practicable, all work in a given sidewalk work zone is complete before fully reopening that segment for public use. The work that the City expects to be completed during a single sidewalk closure shall include, but not be limited to: removal and resetting of curb; placement of lighting conduit; removal of old light poles and placement of new bases and poles; demolition of existing sidewalk and construction of new sidewalks; and other items requiring excavation or substantial disruption to pedestrian activity.

3.6 GENERAL SEQUENCING REQUIREMENTS FOR POROUS PAVEMENT INSTALLATION

- A. This Section specifies construction sequencing requirements for the following work:

1. Refer to Specification Section 02510 – HOT MIX ASPHALT POROUS PAVING.
2. Refer to Specification Section 02500 – PAVING AND SURFACING.
3. Hot Mix Asphalt Porous Pavement shall not be placed between October 31st and May 1st.
4. Porous pavement shall be placed in 2 – 2inch layers.
5. No traffic loading is allowed on choker course, reservoir course and filter medium layers in the porous pavement trench.
6. Contractor to control surface run-off water from entering the porous pavement trench.

3.7 GENERAL SEQUENCING REQUIREMENTS FOR COORDINATION WITH ABUTTING RESIDENCES AND BUSINESSES

A. This Section specifies construction sequencing requirements for the following work:

1. Contractor to coordinate with abutters to minimize shut-down durations for installation of water services.
2. Contractor to maintain access to abutters at all times. Sidewalks adjacent to an abutter entrance shall be installed within two (2) weeks from the beginning of removal of existing sidewalk and/or curb adjacent to the abutter entrance.
3. For water service and sewer connections or any other work affecting the water service provided to commercial properties, the Contractor shall be prepared to complete work during off-peak hours, including night work, at no additional cost to the City.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 01063

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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
AAB	Architectural Access Board
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
SMACCNNA	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 "MHD Standards" and/or "MASSDOT Standards" shall mean, the Massachusetts Department of Transportation – Highway Division 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 no 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 (7) 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 (3) 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 twelve (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, Revision 1, Inman Square Intersection Safety Improvement Project, Cambridge, Massachusetts" memorandum are attached 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 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 twelve (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.
 - 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.

- 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

SECTION 01200

GENERAL REQUIREMENTS FOR UTILITY WORK

1200.1	TEMPORARY UTILITY SUPPORT AND COORDINATION	LUMP SUM
1200.2	BIKE SHARE STATION RELOCATION	ALLOWANCE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies general requirements for construction, protection, support, maintenance, and restoration for underground and overhead utilities affected by construction of the Project. This section includes coordination with private utility companies. The Work includes new construction, reconstruction, relocation, and abandonment.
- B. The utility works and services that may be affected include, but are not limited to:
 - 1. Storm drain, sanitary sewer, and combined sewer
 - 2. Water distribution and transmission mains
 - 3. Gas distribution and transmission
 - 4. Electric power, utility poles, and street lighting (underground and overhead)
 - 5. Telephone
 - 6. Traffic signals
 - 7. Fiber optic communications
 - 8. Cable Television
 - 9. Signal communication
 - 10. City fire signal lines and pull boxes
 - 11. Steam
 - 12. MBTA overhead and underground electric
 - 13. BlueBikes Station by Motivate
- C. This Section shall be used in conjunction with the specific underground utility work sections that apply to the Contract.

1.2 WORK BY UTILITY COMPANIES

- A. Certain parts of the utility work shall be performed, where shown or specified, by the utility company.

- B. Disconnecting and connecting of storm drains; sanitary sewers; and combined sewers services shall be the Contractor's responsibility as required in the Specifications or after having received permission from 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 received permission from 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 prior to the scheduled date for commencement of work under this Contract.
- D. Work performed by utility companies to facilitate the Work under this Contract, and other work performed by utility companies solely for the convenience of the Contractor, shall be at no additional cost to the Owner.

1.3 DEFINITIONS

- A. Abandoned means that use of a utility asset has been discontinued by the utility company.
- B. To be abandoned means that use will be discontinued as part of the Work under this Contract.
- C. Maintenance means providing continuous 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 under 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, procedures for restoration and method of testing to demonstrate restoration was performed satisfactorily.
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 or tree damage caused by negligence or failure to follow proper procedures or the Contract requirements, including possible removal of Contractor personnel from the site.
 - g. Techniques proposed to identify and protect existing tree roots from damage, including notification of the City's arborist, exploration procedure with air spade, and protection of exposed roots as outlined in section 02100.
4. Submit an emergency action plan outlining procedure 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 3.11 of this Section.

1.5 APPROVAL BY UTILITY COMPANIES

- A. All personnel performing work on to expose and support existing 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 thirty (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. Eversource Gas Requirements:
 - 1. If cut-off or connection is expected, notify the Eversource 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 is observed, regardless of the proximity to an existing gas facility.

3. Gas valves to remain exposed at all times during work. Contractor to coordinate with Eversource Gas at least two (2) weeks prior to any required gas valve adjustments (raising or lowering).
4. At locations where the sand bedding material of gas mains are excavated and removed by the Contractor, the Contractor shall put back or replace the bedding material, in kind. Crushed stone shall not be used as backfill for bedding material beneath gas mains.

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.
- 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. Provide temporary support plans and design stamped by a Professional Engineer in the Commonwealth of Massachusetts as required by the utility owner.
- 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.
- G. In addition to notices previously specified, the Contractor shall notify the Cambridge Water Department, Owner, and Engineer forty-eight (48) hours prior to excavating or working near the existing large diameter (>18-inch) water transmission main.
- H. Permits to excavate the public way cannot be issued until the applicant has notified the appropriate utility companies, as required by Massachusetts General Laws, Chapter 370 of the Acts of 1963. The applicant must either: 1) obtain written receipts from the affected utilities and provide copies of same to the owner; or 2) utilize the Dig-Safe System for the required notifications, and also submit written notifications for those utilities not participating in the Dig-Safe System. Written notifications must state that utility companies have been notified and the contractor cleared to begin work.

The following utility companies must be notified in writing:

M.B.T.A. (617) 222-3200
 10 Park Plaza, Suite 3910
 Boston, MA 02116

M.W.R.A. (617) 242-6000
 100 First Avenue
 Charlestown Navy Yard
 Boston, MA 02129

The following utility companies must be notified in writing or through Dig-Safe.

Enbridge (781) 329-3750 x7710
 Attention: Peter Kerrigan
 pfkerrigan@spectraenergy.com
 Westwood Area Office 1-800-726-8383
 8 Wilson Way
 Westwood, MA 02090

Verizon Attention: Matt King matthew.i.king@one.verizon.com 275 Wildwood St. Woburn, MA 01801	(781) 376-8172
KeySpan Gas Attention: Mr. Dennis Peri 201 Rivermoor Street West Roxbury, MA 02132	(617) 323-9210
Eversource Electric Attention: Matt Viens Matthew.viens@eversource.com 1165 Massachusetts Avenue Dorchester MA 02125	(401) 473-1508
Veolia Steam Attention: John Moloney john.moloney@veolia.com 53 State Street, Suite 14 Boston, MA	(857) 401-9812
Eversource Gas Attention: John Daly John.daly.jr@eversource.com 101 Linwood Drive Somerville, MA 02143	(781) 441-3206
COMCAST Attention: Anthony Vataloro Anthony_Vataloro@cable.comcast.com 55 Concord St. North Reading, MA 01864	(617) 279-7037
Cambridge Water Department Attention: Steve Lush slush@cambridgema.gov 250 Fresh Pond Parkway Cambridge, MA 02138	(617) 349-4770
Cambridge Electrical Department Attention: Steve Lenkauskas slenkauskas@CambridgeMA.GOV 489 Broadway Cambridge, MA 02138	(617) 349-4900

Bay State Network Services
Ben Whitaker
bwhitaker@baystatens.com
4 Meredith Way, Suite # 4
Rockland, MA 02370

(617) 429-3847

Dig-Safe
811

At least a 72 business hour notice is required for DIG SAFE in Massachusetts.

The Contractor shall have all utilities marked out along the course of this work by such means as the Owner shall approve and shall preserve such marked locations until the work has progressed to the point where the encountered utility is fully exposed and protected as required. It shall be the Contractor's responsibility to notify utilities at least 48 hours prior to the start of any excavation.

The Contractor is responsible for contacting any other utilities that are not listed herein.

3.2 SUBSURFACE UTILITY INVESTIGATION

- A. The Contractor shall excavate test pits where indicated on the Contract Drawings and as specified.

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, the Contractor shall notify 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 that interfere with 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 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 controlled density fill (CDF) unless otherwise indicated. Remove abandoned utility manholes, junction boxes, and similar

structures to a minimum depth of four (4) feet below finished 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 under this Contract. Clean all utility structures of dirt caused by Work under 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.

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 shall restore the project area and adjacent affected areas to a neat and clean condition.

3.11 AS-BUILT 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 work, including verification of the existing survey data, shall be performed by a licensed Professional Land Surveyor registered in Massachusetts to accurately record progress of the work throughout the duration of the Contract
 - 1. The Surveyor is subject to the approval of the Owner. The Contractor shall submit the qualifications of the Surveyor documenting performance of similar scopes of work utilizing software specified below.
 - 2. All coordinates shall be geographically registered in the project datum coordinate system using the control points for horizontal and vertical controls.
 - 3. Horizontal accuracy shall be 0.01 feet.
 - 4. Elevation accuracy shall be 0.1 feet except benchmarks, topography, and structure foundations (including manholes pipe inverts) shall be accurate to 0.01 feet.
 - 5. Digital As-built drawings, including surface data shall be provided in AutoCAD Civil 3D format to match the text styles and line types of the design drawings provided by the Engineer.
 - 6. It is recommended that the Surveyor attend the Preconstruction meeting.
 - 7. Prior to submitting a monthly payment application, the Contractor's progressive electronic as-built drawings shall be acceptable to the Engineer.

D. The Contractor shall also maintain red line record documents at the site to accurately record progress of the work throughout the duration of the Contract.

1. Contractor shall delegate the responsibility for maintenance of the record documents to one person on the Contractor's staff as approved by the Owner.
2. Changes to the record documents shall be coordinated with adequate and proper entries on each page of the specifications and each sheet of drawings and other documents where such entry is required to show progress and changes properly, including change orders, approved shop drawings, RFIs, and other modifications.
3. Record information shall be updated within 24 hours of installation or survey.
4. All locations of utilities exposed by the work shall be checked with the plans. Utilities not shown as indicated on the plans shall be recorded and show in its accurate location with notes about where the utility is located at versus what is shown on the plans and submitted with the record drawings.
5. All utilities shall be recorded whether shown on the plans or not and shall be submitted with the record drawings.

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, MBTA, 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, including plan stamped by a Professional Engineer in the Commonwealth of Massachusetts; coordinate the protection of and

protect all overhead utilities; and perform all coordination with the utility companies for the relocation, abandonment, 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.

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.

Item 1200.2 – Bike Share Station Relocation

METHOD OF MEASUREMENT:

Measurement for payment for Bike Share Station Relocation will be based on the actual costs of reimbursing Motivate Inc. to relocate bike share stations. The General Contractor is allowed up to a 5% mark-up on labor, professional service, technician, and other costs related to bike share station relocation.

BASIS OF PAYMENT/INCLUSIONS:

Payment for Bike Share Station Relocation will be based on documented costs for this item. Under the Allowance for this item, the Contractor shall coordinate and reimburse bike share station operator Motivate Inc. for the costs associated with relocating bike share stations.

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. Shop Drawings and engineering data (submittals) covering all equipment and all fabricated components and building materials which will become a permanent part of the Work under this Contract shall be submitted to Engineer for review, as required. Submittals shall verify compliance with the Contract Documents and shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and the operation of component materials and devices; the external connections, anchorages, and supports required; the performance characteristics; and dimensions needed for installation and correlation with other materials and equipment.
 1. Each submittal shall cover items from only one section of the specification unless the item consists of components from several sources. Contractor shall submit a complete initial submittal including all components. When an item consists of components from several sources, Contractor's initial submittal shall be complete including all components.
 2. All submittals, regardless of origin, shall be clearly identified with the name and number of this Contract, Contractor's name, and references to

applicable specification paragraphs and Contract Drawings. Each submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted, applicable items shall be clearly identified, and inapplicable data crossed out. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data. Engineer will not accept submittals from anyone but Contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

3. All deviations from the Contract Documents shall be identified as deviations on each submittal and shall be tabulated in Contractor's letter of transmittal. Such submittals shall, as pertinent to the deviation, indicate essential details of all changes proposed by Contractor (including modifications to other facilities that may be a result of the deviation) and all required piping and wiring diagrams.
4. Contractor shall submit shop drawings electronically. For electronic submittals, drawings and the necessary data shall be submitted electronically to Engineer as specified below. Submittal documents shall be in black and white unless color is required for the review of the submittal. All electronic files shall be in Portable Document Format (PDF) as generated by Adobe Acrobat Professional Version 7.0 or higher. The PDF file(s) shall be fully indexed using the Table of Contents, searchable with thumbnails generated. PDF images must be at a readable resolution. For most documents, they should be scanned or generated at 300 dots per inch (dpi). Optical Character Recognition (OCR) capture must be performed on these images so that text can be searched, selected and copied from the generated PDF file. The PDF documents shall have a bookmark created in the navigation frame for each major entry ("Section" or "Chapter") in the Table of Contents. Thumbnails shall be generated for each page or graphic in the PDF file.

The opening view for each PDF document shall be as follows:

- Initial View: Bookmarks and Page
- Magnification: Fit In Window
- The file shall open to the Contractor's transmittal letter, with bookmarks to the left. The first bookmark shall be linked to the Table of Contents.

PDF document properties shall include the submittal number for the document title and the Contractor's name for the author. Electronic submittal file sizes shall be limited to 10 MB. When multiple files are required for a submittal the least number of files possible shall be created. The contractor shall post submittals and retrieve the Engineer's submittal review comments through the Engineer's project website accessible through the Internet. Instruction on procedures for posting and retrieving submittals will be provided after award of the Contract. Facsimiles (fax)

will not be acceptable. Engineer will not accept submittals from anyone but Contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

5. In addition, upon request two hard copies of each *full-size* drawing shall be submitted to Engineer who will return two marked copies (or one marked reproducible copy) to Contractor.
 6. Engineer's submittal review period shall be a maximum of twenty-one (21) consecutive calendar days and shall commence on the first calendar day following receipt of the submittal or resubmittal on the project website. The time required to mail any hard copies of the submittal or resubmittal back to Contractor shall not be considered a part of the submittal review period.
 7. Contractor shall accept full responsibility for the completeness of each resubmittal. Contractor shall verify that all corrected data and additional information previously requested by Engineer are provided on the resubmittal. When corrected copies are resubmitted, Contractor shall direct specific attention to all revisions in writing and shall list separately any revisions made other than those called for by Engineer on previous submittals. Requirements specified for initial submittals shall also apply to resubmittals. Resubmittals shall bear the number of the first submittal followed by a letter (A, B, etc.) or a unique identification that indicates the initial submittal and correct sequence of each resubmittal. Resubmittals shall be made within 60 days of the date of the letter returning the material to be modified or corrected, unless within 30 days Contractor submits an acceptable request for an extension of the stipulated time period, listing the reasons the resubmittal cannot be completed within that time. The need for more than one resubmittal, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Times unless delay of the Work is the direct result of a change in the Work authorized by a Change Order or failure of Engineer to review and return any submittal to Contractor within the specified review period.
- 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.
- I. Submittals requiring a Certificate of Design will be considered incomplete and not acceptable unless a complete Certificate of Design is submitted.
- J. The Certificate of Design requires that the engineer providing the submittal carries Professional Liability insurance meeting the requirements laid out in Section 00800 "General Terms and Conditions" and additionally meeting the requirements of Section 00825 "Supplemental General Conditions".

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.

1.7 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

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. Where submittals are required hereunder, the Contractor shall submit an electronic copy and four hard copies of each submittal item.

1.3 INITIAL SCHEDULE SUBMITTALS

- A. The Contractor shall submit two (2) short term schedule documents at the First Progress Meeting which shall serve as the Contractor's Plan of Operation for the initial sixty (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, 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 (3) 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.

1.4 SCHEDULE SUBMITTALS

- A. Original Schedule Submittal: Within thirty (30) calendar days after the commencement date stated in the Notice to Proceed, the Contractor shall submit for review by the Owner an electronic and a hard copy of the 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.
- B. Original 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 schedule submittal. The Contractor shall have the Project Manager and Project Superintendents 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.
- C. Revisions to the Original Schedule: Within fifty (50) calendar days after the commencement date stated in the Notice to Proceed, the Contractor shall have revised the original schedule submittal to address all review comments from the original schedule review meeting and resubmit the Schedules and reports for the Owner's review. The Owner, within fourteen (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. When the schedule is accepted, it shall be considered as the "Original 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.
- D. 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.

- E. 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.
- F. Monthly Updates and Periodic 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. 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.
- G. 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.
- H. 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. 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 Schedule with the Contractor's Application for Payment. Applications for Payment which are submitted without the proper Schedule 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 made from the previous schedule. The Contractor shall modify any portions of the schedule which become infeasible because of activities behind schedule or for any other valid reason.

1.5 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 schedule by the Contractor.

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. Estimated Activity Duration
 - 2. Activity Description
 - 3. Start Date
 - 4. Finish Date
- 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. If an update, cite the new schedule completion date

1.9 PROJECT STATUS REPORTING

- A. In addition to the submittal requirements for the scheduling identified in this Section, the Contractor shall provide monthly project status reports (Overview Bar Chart and a written narrative report). 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 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. The initial submittal of the overview bar chart schedule shall be made at the time that the revised original 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 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.
 - 5. A list of the critical activities scheduled to be performed in the next two (2) 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 shall include copies of the last month's daily logs, field reports, and As-Built redlines with the written monthly narrative report.
 - F. 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 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 01390

PRE-CONSTRUCTION SURVEY

1390.1	EXTERNAL BUILDING INSPECTION	EACH
1390.2	INTERIOR BUILDING INSPECTION	ALLOWANCE

PART 1 - GENERAL

1.1 SUMMARY:

- A. The work under this item shall consist of the furnishing all necessary labor, equipment, professional services, and materials required to perform preconstruction condition surveys to document the condition of all exterior surface features, building exterior surfaces and interiors of buildings indicated on the plans or as otherwise required by the Geotechnical Engineer by an independent Consultant employed by the Contractor.
- B. Pre-construction surveys shall be performed on the buildings indicated on the plans prior to commencement of work.
- C. Pre-construction surveys shall be performed on the buildings indicated on the plans no earlier than four (4) weeks before commencement of work.
- D. Perform additional interior and/or exterior pre-construction conditions surveys as directed by the Engineer.
- E. Perform post-construction survey at properties where a damage claim has been reported.

1.2 QUALITY ASSURANCE

A. Qualifications

- 1. The contractor shall retain the services of a Massachusetts Registered Professional Civil/Structural Engineer to perform pre-construction condition surveys on the structures described above. The Registered Professional Engineer shall have at least five (5) years experience and three (3) projects in performing pre-construction surveys of heavy civil construction projects similar to this project, including work in urban areas, and a record of performance in completing condition surveys of similar types of structures and buildings. The Contractor shall submit such qualifications for review and acceptance prior to beginning work.

2. 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.
3. The presence of the Engineer (including observations and review of the data) 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.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01300 Submittals.
- B. Within thirty (30) days of Notice to Proceed and prior to performing any photography and video work, submit the qualifications of Professional Engineer(s) that will perform the pre- and post-condition survey of building as specified in paragraph 3.1 of this section, and qualification of the firm performing the photography and video recording work. Include a list of projects and a sample report to demonstrate compliance with paragraph 1.2.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 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.
- D. Within thirty (60) days of Notice to Proceed, submit four (4) copies of pre-construction "Pre-Construction Building Condition Survey" reports and videos (on DVD) of buildings as indicated in on the Drawings to ENGINEER.
- E. Submit separate reports for each structure in accordance with Section 01300 – SUBMITTALS. Each report shall include the following, as a minimum
 1. Location and description of property and improvements
 2. Results of visual inspections including sketches, photographs, and DVD video showing deterioration or lack of deterioration.
 3. Information provided by property owners.
 4. Photo CD containing all the photos taken of the property.

1.4 PROPERTY ACCESS

- A. Right of entry for building conditions survey: Contractor shall obtain the right of entry for all structures to be surveyed.

- B. 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 two (2) weeks after the ENGINEER has provided notice to the building owners.

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION SURVEY

- A. Pre-construction surveys shall be performed on the properties and structures indicated on the plans. Survey shall include detailed examination of the structure exterior and interior including documentation of exterior visual survey of the property, onsite improvements and plantings; detailed video inspection of the exterior of building and interior areas; digitized color photographs of the interior/exterior showing visually evident structural faults, and including but not limited to:
 - 1. Exterior façade and interior of buildings indicated on the plans.
 - 2. Location and of cracks in interior and exterior walls, especially instances of cracked or missing plaster or bricks within the defined survey areas;
 - 3. Damaged masonry or roofing within the defined survey areas;
 - 4. Walls which are not vertical within the defined survey areas;
 - 5. Damage to foundations, including interior/exterior; and tightness of fit of doors and windows in their respective jambs.
 - 6. Sidewalks, planters, paved areas, utility poles, stairways, patios, fencing and landscaped areas including condition of trees to be measured.
- B. 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.
- C. The design professional conducting the survey shall interview the property owners regarding existing conditions and structural faults and determine dates and extent of recent repairs. This information shall be documented in the reports.

PART 4 – COMPENSATION

Item 1390.1 – External Building Inspections

METHOD OF MEASUREMENT:

Measurement for payment for Internal and External Building Inspections will be based on the per Each bid as approved by the Engineer.

BASIS OF PAYMENT/ INCLUSIONS:

Under the Unit Price for External Building Inspections, the Contractor shall furnish all labor, materials, instrumentation, tools, equipment, and incidentals required to complete an external building inspection for each building. Payment under this Item includes, but is not limited to, obtaining Right of Entry(ies), up to 3 documented attempts to notify the property owner(s) via certified mail; video inspection and documentation of external conditions; delivering report of inspection and post-construction inspections of properties where a damage claim has been reported.

Contractor to provide schedule of values for the completion of external inspection, and documented attempt for each unit. In the event property owner is unable to be contracted, the contractor will receive partial payment for external inspection and documented attempts.

Item 1390.2 – Interior Building Inspections

METHOD OF MEASUREMENT:

Payment will be made against the allowance based on invoices submitted by the General Contractor on a monthly basis. Labor, professional services, technician, and other invoices shall include a breakdown of hours, labor rates, direct expenses of all sub-consultant and contractor mark-ups, material costs, shipping, taxes and all other costs included in the request. Incomplete or incorrect invoices will not be approved.

The General Contractor is allowed up to a 5% mark-up on labor, professional service, technician, and other costs related to interior building inspections as approved by the resident engineer.

BASIS OF PAYMENT/ INCLUSIONS:

The allowance for this item shall be reimbursement to the General Contractor to furnish all labor, professional services, technician, equipment, and incidentals for the Contractor to complete Interior Building Inspections as required by the Engineer and not included in other pay items.

EXCLUSIONS AND SPECIAL NOTES:

Payment for External Building Inspections shown on the Contract Drawings shall be paid for under Item 1390.1 External Building Inspections.

END OF SECTION 01390

SECTION 01400

QUALITY CONTROL

1400.1 QUALITY CONTROL AND TESTING ALLOWANCE

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 required by the Engineer.

1.3 LAYOUT OF WORK

- A. The Contractor shall employ 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 a Registered Land Surveyor, approved by the Engineer and cause him to establish permanent benchmarks 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.

1.4 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.

1.5 HYDRANTS

- A. Fire hydrants on or adjacent to the work shall be kept accessible to fire-fighting equipment at all times.

1.6 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 fifteen (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 fourteen (14) days of observation to Engineer for review.

1.7 THIRD-PARTY MATERIALS TESTING

- A. The Contractor shall employ a qualified third-party quality control testing company certified in the applicable materials testing procedure required by the Specifications and shall have adequate staffing available and laboratory capacity to provide testing results in a reasonable timeframe. The quality control testing company hired by the Contractor shall be subject to approval by the Owner and Engineer.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 – COMPENSATION

Item 1400.1 – Quality Control and Testing

METHOD OF MEASUREMENT:

Payment will be made against the allowance based on invoices submitted by the General Contractor on a monthly basis. Labor, professional services, technician, and other invoices shall include a breakdown of hours, labor rates, direct expenses all sub-consultant and contractor mark-ups, material costs, shipping, taxes and all other costs included in the request. Incomplete or incorrect invoices will not be approved.

The General Contractor is allowed up to a 5% Mark-up on labor, professional service, technician, and other costs related to testing.

BASIS OF PAYMENT:

The allowance for this item shall be reimbursement to the General Contractor to furnish all labor, professional services, technician, equipment, and incidentals for testing required in this contract and not included in other pay items. The work includes, but is not limited to, testing for: backfill compaction, concrete and Hot Mix Asphalt standard paving compaction testing items.

SPECIAL NOTES/EXCLUSIONS:

Contamination, In-situ Soil density, pipe and manhole testing, water main testing, test pits, traffic signal, landscape and tree planting soils, lighting and all other testing not explicitly called out in this Section will not be paid for under this item and are covered under separate pay items.

END OF SECTION 01400

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SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

1500.1 TEMPORARY ORNAMENTAL TREE LIGHTING LUMP SUM

PART 1 - GENERAL

1.1 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.

1.2 PRIVATE LAND

- A. The Contractor shall not enter or occupy private land outside of easements, except by permission of the property 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 utilities, structures or for other reasons.
- B. 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

- 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, construction and caution signs, concrete barriers, protective 7' tall fencing, lights and other means to prevent accidents to persons, vehicles, 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. All trenching operations and end of day conditions shall be in accordance with Jackie's Law, (520 CMR 14.00).

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 in accordance with the requirements of the Engineer, as shown on the Drawings, or described in the Specifications, or as directed by the Owner or Engineer. Test pits shall be backfilled and compacted 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, 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. The Contractor shall bear full responsibility for obtaining all locations of underground structures, utilities, and services. 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. 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

- 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, or any daily 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 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 protected against injury as described in 02100 SITE PREPARATION AND TREE PRUNING.
- 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.

1.14 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 Water: Water for drinking purposes and other usage will be provided by the Contractor at his own expense.
- D. 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.
- E. 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 twenty-four (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.

1.15 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 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.

1.16 POLLUTION CONTROL

- A. Refer to section 01560 TEMPORARY ENVIRONMENTAL CONTROLS.

1.17 TEMPORARY ORNAMENTAL LIGHTING

- A. The Contractor shall furnish and install temporary ornamental tree lighting. The ornamental tree lighting shall be maintained in working order throughout the duration of the contract and removed at the end of the Contract.
 1. Ornamental tree lighting shall be installed on Hampshire Street

between Cambridge Street and Prospect Street.

- B. Ornamental tree lighting shall be installed following pre-construction tree pruning as described in section 02100 SITE PREPARATION AND TREE PRUNING.

PART 2 – PRODUCTS

2.1 TEMPORARY BARRIERS

- A. Refer to 01570 MAINTENANCE AND PROTECTION OF TRAFFIC for barriers and fencing for temporary protection of work zone.

2.2 ORNAMENTAL LIGHTING

- A. Temporary ornamental lighting shall be Commercial Grade LED Wide Angle string lighting by Novelty Lights Inc or approved equal. Ornamental lighting shall be UL Listed for Outdoor use.
 - 1. Bulb Color: Warm White
 - 2. Wire Color: Green
 - 3. Minimum Length: 100-ft
 - 4. Bulb: 5mm wide angle
 - 5. Spacing: 6-in between bulbs
- B. Extension cords for ornamental tree lighting shall be commercial grade, black, not exceeding 50-ft in length.

PART 3 – EXECUTION

3.1 ORNAMENTAL LIGHTING

- A. Temporary ornamental lighting shall be installed prior to any construction activities on site. Prune trees prior to installation of ornamental lighting.
- B. Install string lighting around all branches with diameter 2.5-in or larger. Secure string lighting with 1-in black or brown Velcro wrapping.
- C. Follow manufacturer’s instruction for maximum consecutive connections. Connections shall be wrapped tightly with black electrical tape.
- D. Connect string lighting to existing outlets located on top of “1907” style street light fixtures using extension cord. Excess extension cord shall be zip-tied together and secured in a safe place. Review and coordinate with Cambridge Electric Department to identify lighting layout and location of available outlets.

PART 4 – COMPENSATION

Item 1500.1 --- Temporary Ornamental Tree Lighting

METHOD OF MEASUREMENT:

Measurement for payment for Temporary Ornamental Tree Lighting will be payable upon completion of installation of Temporary Ornamental Tree Lighting as well as 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:

Payment for Temporary Ornamental Tree Lighting 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 install and maintain Temporary Ornamental Tree Lighting. The work includes furnishing string lighting, extension cords, wrapping, and all incidental materials, coordination with the Cambridge Electric Department, installation of string lighting, continuous maintenance, and removal of all string lighting and incidental materials at project completion. Fifty-percent (50%) of the Lump Sum shall be paid upon complete installation of string lighting in working order. The remaining fifty-percent (50%) shall be paid on a monthly basis as a percent of remaining fifty-percent (50%) Lump Sum bid calculated by dividing the elapsed time to date by the contractual construction time limit for which the string lighting is maintained in working order and as approved by the Engineer.

EXCLUSIONS AND SPECIAL NOTES:

The following items are not included for payment under this item and are included for payment elsewhere; installation of proposed street lighting, conduit and wiring, including plaza festoon lighting.

END OF SECTION 01500

SECTION 01505

MOBILIZATION

1505.1

MOBILIZATION

LUMP SUM

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes mobilization consisting of moving all plants and equipment onto the site required for the contractor'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 on-site sanitary facilities and potable water facilities.
4. Arranging for and erection of Contractor's work and storage/staging yard(s).
5. Having all OSHA required notices and establishment of safety programs.
6. Having the Contractor's superintendent and project manager at the job site full time. The project manager shall not have superintendent duties.

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 by percentage complete per the previous listed items 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 3 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 and erecting all temporary fencing (0.2%); furnishing and paying for all utilities (0.2%), furnishing and installing pre-construction traffic management signage (0.2%); distributing contact numbers for Contractor's staff to Owner and Engineer; submission and approval of initial shop drawings (0.2%); submission and approval of Traffic Management Plans (0.2%); submission and approval of initial work plans and sequencing plans (0.2%); installing temporary power, lighting and water for construction purposes (0.2%); implementing security features (0.2%); furnishing and installing temporary sanitary facilities (0.2%); transporting all necessary trucks and construction equipment to the site necessary to begin construction (0.2%); 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 twenty percent (20%) 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. Failure to maintain positive and effective dust control may result in a suspension of the work, at no additional cost to the Owner, until dust control is addressed to the Owner's satisfaction.
- F. 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.
- G. 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.

1.2 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTAL PROCEDURES:
 - 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 composting sock.
 - 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, composting socks, 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.

PART 2 – PRODUCTS

2.1 COMPOSTING SOCKS

- A. Composting socks shall consist of a three-dimensional tubular sediment control

and storm water runoff filtration device.

- B. The compost material for the composting socks shall consist of unvegetated composting material and be made with sanitized, mature compost that has no identifiable feedstock constituents or offensive odors. The compost used in the composting sock shall meet all local, state, and Federal quality requirements.
- C. The mesh material for the composting socks shall be biodegradable.

2.2 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, at no additional cost to the Owner.

3.2 INSTALLATION

- A. Composting Socks shall be placed to form temporary water stops, dams,

diversions, dikes, berms and for other uses connected with water pollution control and; composting socks shall be disposed of by the Contractor upon completion. Composting socks shall be installed per manufacturer's written installation procedures.

- B. 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.
- C. 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.
- D. 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.
- E. Existing natural drainage patterns and vegetative cover shall be preserved to the maximum possible extent.
- F. 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.
- G. On sloping terrain, composting socks may be used to trap sediment until vegetation has become established. The details of their placement shall be as approved by the Engineer.
- H. 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.
- I. 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 composting socks; 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.

END OF SECTION 01568

SECTION 01570

MAINTENANCE AND PROTECTION OF TRAFFIC

1570.1	TRAFFIC AND PEDESTRIAN MANAGEMENT	LUMP SUM
1570.2	REMOTE CONTROLLED CHANGEABLE MESSAGE SIGN	UNIT WEEK
1570.3	TEMPORARY ROADWAY STRIPING	LINEAR FOOT

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, transit, 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, Parking and Transportation Department and Department of Public Works four (4) weeks prior to proceeding with the work.
- D. Coordination with MBTA is also required for temporary relocation of bus stops if work zones impact existing MBTA bus stops.
- E. 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.
- F. 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. All traffic signs provided by the Contractor must be gender-neutral.

- G. “Approved by the Owner” throughout this Section shall mean the approval of the Cambridge Department of Public Works and Traffic Parking and Transportation Department.
- H. 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.
- I. Designated accessible parking spaces must be maintained at all times. If a designated accessible parking space must be impeded the contractor must make arrangements to temporarily relocate the spot to the nearest reasonable space as possible. The contractor must coordinate relocating an accessible parking space ahead of time with the City and the Engineer. The Contractor must supply MUTCD and City approved signage to designate the relocated accessible spot. The accessible spot must be coordinated with the intended user and notification shall be provided in advance.

1.2 REFERENCES

- A. Reference is made herein to the MassDOT, 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. The Plan must specifically identify any proposed temporary relocation

of MBTA or private bus stops; and/or detours of MBTA or private bus routes from their pre-construction routings. 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). Traffic management Plans shall depict the actual site, traffic lights, pedestrian crosswalks, proposed MUTCD traffic control signs, proposed vehicular detours, bike lanes and their protection thereof, pedestrian travel, pedestrian detours, sidewalk closed and pedestrian detour routes and signage, maintenance of ADA access, temporary pedestrian ramps if the sidewalk closures are not at existing ADA ramps, accessible parking spaces, bus stops for public, school and private busses

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 (4) 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.
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. Equipment and materials shall be stored at least fifty (50) feet away from an intersection so as to not obstruct turning radii for emergency vehicles or lines of sight and is subject to approval by the City and the Engineer.
- 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. Use of steel plates are as approved by the City and the Engineer. Steel plates shall be removed from the right of way during inclement weather. The subsurface shall be flat to minimize deflection of the plates. Steel plates shall be supported to allow for H-20 loading when traffic is resumed on top of the plates. All steel plates shall be signed with "STEEL PLATES AHEAD" to advise motorists of the steel plates.
- 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 unless otherwise approved.
- G. The Contractor shall provide temporary lighting to properly illuminate the work area and approaches in the event of nighttime work. Equipment must not exceed 65 decibels (dB) measured 10 feet away.
- 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.

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.

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 and approved by the City and the Engineer. Any material approved to be stored in the roadway shall be at a minimum of fifty (50) feet away from an intersection to allow for all emergency response vehicles to navigate the corners and intersections and to minimize line of sight obstruction.
- 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. If permitted by the City and the Engineer; 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. All equipment parking and storage must be approved by the City and Engineer. Any equipment approved to be stored in the roadway shall be at a minimum of fifty (50) feet away from an intersection to allow for all emergency response vehicles to navigate the corners and intersections and to minimize line of sight obstruction.

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.
- D. Existing pavement marking shall be maintained at all times. When existing pavement marking are disrupted by the work they shall be replaced at no additional expense to the Owner.

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 TRAFFIC

- 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.

- a. The Contractor shall be responsible for coordination with the Cambridge Fire Department, specifically as it relates to access for the Inman Square Fire House located at 1384 Cambridge Street.
3. The Contractor shall provide for one travel lane in each direction of Cambridge and Hampshire Streets (minimum 15 foot width to accommodate both vehicles and bicycles) throughout the project area at all times, except for times when one-way travel has been approved per the TMP.
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 nights work are delivered or available to the project site, unless otherwise approved by the Owner, City and Engineer.
9. Accesses to residential and commercial 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 unless otherwise approved.

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 four (4) feet 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 may occupy a maximum of 100' linear feet of curb lane at any time for its operations, or for storage during non-working periods. The remainder of available curbside frontage shall be available for parking/loading or bus stops as appropriate.
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 four (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" AND "MOTORCYCLES USE CAUTION" in advance of all roadway areas which have been cold-planed. If the road has exposed soils place "GRAVEL ROAD AHEAD" signs in advance of the exposed soil sections.
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. Snow shall be removed from the entire right of way

inclusive of the entire traveled way, bike lanes, parking lanes and sidewalks within the areas the contractor is working.

19. Driveways cannot be blocked for weekends. During sidewalk pours the driveway apron must be available for the weekend. If the contractor elects to pour a driveway apron on a Friday they must commit to removing the forms on Saturday morning to allow for driveway access over the weekend. Driveway apron blocking must be coordinated with the property owners ahead of time and in some cases a temporary driveway access must be provided by the contractor to the property at no additional cost to the Owner.
20. Traffic signals shall be maintained in normal operation at all times. Traffic loops shall be repaired immediately if the traffic lights are critical to maintaining traffic flows as in systematic programmed signals that include operation of more than one set of signals at no additional expense to the Owner. Where traffic signals are simple in their application and allowed by the City and Engineer, traffic loops shall be repaired within a week of their disruption at no additional expense to the Owner.

1.12 BICYCLE TRAFFIC

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 fourteen (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 lane over a short distance (approximately 500 feet or less), bicyclists should be routed to share a motor vehicle lane. In locations where bicycles and vehicles share the same lane a "BICYCLES MAY USE FULL LANE" sign shall be placed with the construction signage.
5. 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 pink 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, on a hill, or within a crosswalk.

Steel plates used to support traffic must be at least H-20 rated.

Steel plates that deflect under the weight of vehicles must be removed and reset with additional support provided to minimize deflection.

6. Raised castings: Where raised castings are present after cold planing and/or in anticipation of final paving and/or anytime castings will be left raised for more than 12 hours, provide the following:
 - a. Advance warning signs saying: "Caution – Raised Castings Ahead."
 - b. Spray paint reflective fluorescent pink the raised portions of the castings in their entirety. Spray paint shall be re-applied daily, or as needed, on all raised castings to maintain visibility.
7. 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 pink to provide a smooth transition slope between the pavement layers. Paint shall be reapplied daily, or as needed, to maintain a visible queue of joint.
8. When the roadway or travel lanes narrow due to construction, advance warning signs should be placed at least 20 feet in advance.
9. 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).

10. 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.
11. Advance construction signs shall not be placed in bicycle lanes and shall not otherwise obstruct bicyclists' path.
12. 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.
13. Restore pavement markings for bike lanes within 2 weeks of paving.

1.13 PEDESTRIAN TRAFFIC

- A. Sidewalks and pedestrian ramps shall be maintained at all times through the construction period. Temporary sidewalks, pedestrian detours, crosswalks and other pedestrian facilities shall be constructed as needed to maintain pedestrian traffic and business access, as shown on the plans or as ordered. The Contractor shall anticipate that temporary pavement markings (paint or tape) will be required in order to comply with this provision. **Constructed items such as approved temporary sidewalks and ramps will be paid for under the appropriate items of the Contract. Temporary signs, markings and other traffic control devices will be paid for under Item 1570.1 Traffic and Pedestrian Management.**
 1. Pedestrian access will be provided to abutting land users at all times, as approved by the City and in accordance with MUTCD, ADA and AAB requirements.
 2. Unobstructed walkways of 4 feet minimum width, unless otherwise approved by the City, shall be provided at all times.
- B. Temporary pedestrian walkways shall be separated from roadway and construction areas by barricades as approved by the City. Barricades shall be paid for as part of Item 1570.1 Traffic and Pedestrian Management.
- C. 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.
- D. 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.

- E. 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.
- F. 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.
- G. 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 occurrence, from Contract payments due.
- H. 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).

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.
4. All construction signage that cannot be removed at the end of the day shall be covered at the end of the work day during non-work hours.

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.
3. Traffic signals shall be maintained in normal operation at all times. Traffic loops shall be repaired immediately if the traffic lights are critical to maintaining traffic flows as in systematic programmed signals that include operation of more than one set of signals at no additional expense to the Owner. Where traffic signals are simple in their application and allowed by the City and Engineer, traffic loops shall be repaired within a week of their disruption at no additional expense to the Owner.

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. Fencing shall be affixed to the barriers to a height of six feet above the road surface and shall not have any holes in the perimeter barriers or fencing larger than the chain link fencing spacing (2 inches by 2 inches). 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, four (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” seven (7) feet high, or as required by the Owner, City and Engineer. The top two (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. Remote Controlled Changeable Message Signs

1. The internally illuminated changeable message sign shall consist of a magnetically operated matrix, LED, fiber optic, or lamp matrix message board; a diesel engine driven generator power supply; hardware for connection to a 110 volt power source; and a computer operated interface, all mounted on a towable, heavy duty trailer.
2. In the raised position, the bottom of the sign shall be at least seven (7) feet above the pavement surface. The sign shall be clearly legible for a distance of 900 feet.
3. The sign shall be controlled by an on-board computer. The sign shall automatically change to a pre-selected default message upon failure. That default message shall remain on display until the problem is corrected.
4. The Remote Controlled Changeable Message Sign unit shall be equipped with a security system to prevent unauthorized access. The security system shall allow access only through use of a code or password unique to that sign. If the proper code or password is not entered within 60 seconds of initial telephone contact, the call will be terminated. Remote control for the changeable message sign shall be by cellular telephone and touch tone modem decoder.
5. The lamp matrix, LED or fiber optic sign, shall be equipped with a top-mounted photocell for automatic sign dimming during nighttime use.
6. The remote controlled portable changeable message sign shall be capable of performing all functions at ambient temperatures ranging from -31° to 165°F (-35 to 74°C). There shall be no degradation of operation due to fog, rain or snow. Maintenance shall include periodic cleaning. When not being used the sign shall be stored in a secure area approved by the Engineer.

7. Message Sign
 - a. Type – The technology can be LED or a combination of both Flip Disk and LED (Hybrid).
 - b. Matrix Displays – Shall be character, line or full matrix.
 - c. Size – The message sign shall have a minimum height of 6 feet, maximum height of 6.5 feet and a minimum width of 8 feet, maximum width of 12 feet.
 - d. Colors – The display shall be either fluorescent yellow or ITE amber.
 - e. Lines – The message sign shall have the capability of displaying at least three lines of 18 inch characters with a minimum of 8 characters per line.
8. The sign shall be capable of storing 100 pre-programmed messages and be able to display any one of those messages upon call via the trailer-mounted terminal or through the cellular telephone hookup.
9. The sign shall be capable of operation from a diesel powered generator, a battery, or solar power. The power supply shall be protected from the weather and be locked for security.
10. The trailer shall include swivel jacks capable of leveling the trailer on a 1:6 (1 vertical to 6 horizontal) slope and capable of stabilizing the trailer in winds of up to 80 miles per hour. The sign shall be capable of being locked in a stowed position while being towed

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 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.
- E. Provide street sweeping within the work limits to maintain safe and efficient vehicular and pedestrian traffic flow, including accesses and sidewalks. 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.
- F. Street sweeping shall be done a minimum twice per week by mechanical sweepers capable of adding water to the sweeping operation as directed by the Owner. Power brooms are prohibited. Small mechanical sweeps (not including power brooms) should be done in conjunction with watering operations unless otherwise approved by the Owner. Sweeping, watering, and/or the use of calcium chloride shall be used at a minimum at the end of each day and more frequently as directed by the Owner. Temporary paving as a means of dust control shall be completed, at a minimum each Friday, or more frequently, as directed by the Owner.
- G. 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.
- H. 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.
- I. Pedestrian access shall be maintained at all times. Access shall be a minimum of four (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.
- J. 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. Signs shall be removed or updated immediately upon the completion of the range of dates depicted on the signs.

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, Cambridge Traffic Department, and abutting property owners.
- G. Detour signs shall have a street name placard indicating the name of the road that is being detoured.

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.
6. During inclement weather (hurricanes, high winds, snow, etc.) as directed by the City or the engineer and after the work has suspended for the day or the weekend; remove all signs, barrels, cones and other traffic management devices from the right of way to prevent traffic management devices from blowing over and creating a hazard in the right of way. Any traffic management devices to remain shall be secured in a manner that prohibits winds from blowing them over or prohibits them from serving their intended function.
- 7.

B. REMOTE CONTROLLED CHANGEABLE MESSAGE SIGN

1. The Contractor shall furnish, place, operate, maintain and relocate the sign as required. When the sign is no longer required, it shall be removed and become the property of the Contractor. The cellular telephone required for the Remote Controlled Changeable Message Sign shall be provided to the Engineer for his use, and subsequently returned to the Contractor. When the sign is not in use, it shall either be turned off or turned from view.
2. Any signs that are missing, damaged, defaced or improperly functioning so that they are not effective, as determined by the Engineer and in accordance with the ATSSA guidelines contained in "Quality Standards for Work Zone Traffic Control Devices," shall be replaced by the Contractor at no cost to the State.

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; work zone layouts, 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; furnish, install and maintain temporary pavement markings throughout the duration of construction and to repaint faded pavement markings as needed and as directed by the engineer; 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 - Remote Controlled Changeable Message Sign

METHOD OF MEASUREMENT:

Measurement for Payment for Remote Controlled Changeable Message Sign (CMSs) shall be based on the number of weeks each changeable message sign is provided, moved, removed and maintained, complete, as required by the Owner or Engineer. CMSs which are on site but not requested or approved by the Owner or Engineer shall be at the Contractor's expense, i.e. CMSs which are brought on site earlier than directed, not removed in a timely manner when required, or which are not operational.

BASIS OF PAYMENT:

Inman Square Intersection
Safety Improvement Project
Issued for Bid

MAINTENANCE AND PROTECTION
OF TRAFFIC
01570-22

Payment for Remote Controlled Changeable Message Sign (CMSs) 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 changeable message signs 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 changeable message sign locations; furnishing and setting-up changeable message signs, power supply, programming equipment and appurtenances; maintaining message signs throughout project; relocating message signs 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 CMSs. Additionally, for the "Remote Controlled Changeable Message Sign," the cellular telephone service and telephone charges shall be included.

Item 1570.3 – Temporary Roadway Striping

METHOD OF MEASUREMENT:

Measurement for Payment for Temporary Roadway Striping shall be based on the total linear foot or surface treatment that is installed as specified by the Owner or Engineer.

BASIS OF PAYMENT:

Payment for Temporary Roadway Striping will be based on the linear foot unit price complete 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 installing Temporary Roadway Striping. The work includes, but is not limited to, the following; coordinating with the Owner and Engineer for temporary striping locations; sweeping, furnish, apply, and protect all temporary striping lines; grinding and removing pavement markings and lines no longer required; maintaining temporary striping throughout project; relocating temporary striping to new locations as required by the Owner and Engineer.

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 (1) 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 thirty (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 thirty (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 the Contractor; 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 and shall clean any affected by over spatter on fences, stairs, curbs, plaques, etc. 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, fence and stairs of all grounds and grassed and landscaped areas removed or disturbed or damaged during the construction of the new work, 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, brick, concrete, asphalt walks, fences of all types, railings, signs and sign posts, signal posts, mailboxes 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

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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 the work on public and private property.
- C. The Contractor shall cleanup and restore all areas affected by staging, trailer(s) placement and parking. Restoration includes regrading, re-establishing topsoil and reseeding.
- D. Refer to Specification section 01630 RESTORATION OF GROUNDS AND CLEANING UP.

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 seventy-five percent (75%) 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 seventy-five percent (75%) 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. Testing Results, where required.
 - 3. Close-out of any Permits with local, state and federal agencies.
 - 4. Provide Construction Photographs as described in the General Conditions.
 - 5. New permanent cylinders and key blanks for all locks.
 - 6. Maintenance stock items; spare parts; special tools.
 - 7. Completed as-built / record drawings as described in Section 01200 GENERAL REQUIREMENTS FOR UTILITY WORK.
 - 8. Certificates of inspection and acceptance by local governing agencies having jurisdiction.
 - 9. 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. The Contractor shall comply with the guarantee and warranty requirements contain on the Contract Documents.
- C. 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.

- D. 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.
- 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

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.

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.

1.3 SUBSURFACE DATA

- A. The findings of recent subsurface investigations are provided in the boring log information included in 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 their own judgment and acknowledges that they are 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 they assume 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 may be warranted to satisfy data requirements and shall be the responsibility of the Contractor. Contractor shall submit a work plan that details the Contractor's approach for obtaining the data in accordance with Section 01300 and Section 02080. The work plan shall be reviewed and accepted by the Owner's Licensed Site Professional prior to commencement of any subsurface investigation activities. 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 (Not Used)

PART 4 – COMPENSATION (Not Used)

END OF SECTION 02010

SECTION 02015

GEOTECHNICAL MONITORING AND INSTRUMENTATION

2015.1 **VIBRATION MONITORING** **LUMP SUM**

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. 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 per a crew; one adjacent to the work and one adjacent to the nearest private property. Vibration levels shall not exceed the criteria indicated herein.

 - 2. Furnish, install, protect, replace, monitor and report on ground surface and building deformation monitoring points. The Engineer will assist the Contractor in determining the final locations. Contractor shall conduct site visit with the Engineer at least two weeks prior to the start of construction to determine locations of ground, surface, and utility monitoring points.

 - 3. Pre-Construction Surveys shall be conducted in accordance with Section 01390.

 - 4. At locations where structure and/or monitoring points are required on private property, the Contractor shall obtain a right of entry to obtain access. A Right of Entry form shall be obtained from the property owner prior to conducting an internal building inspection.

 - 5. The Contractor shall retain the services of Geotechnical Monitoring Consultant and Surveyor to install, monitor, maintain and report on geotechnical instrumentation that includes but is not limited to ground surface, building deformation monitoring points, Utility Monitoring Points, crack gauges and vibrations.

 - 6. 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. Submit the qualifications of the Geotechnical Monitoring Consultant and Surveyor at least three weeks prior to the construction:
 2. 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.
 3. A mitigation plan shall be submitted 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.
 4. The Geotechnical Monitoring Consultant and Surveyor 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.
 5. The Geotechnical Monitoring Consultant and Surveyor 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 and depicted graphically on plots and show incremental and cumulative movement since the start of excavation.

1.3 QUALITY CONTROL

- A. 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.
- B. The Contractor may conduct additional testing or monitoring for its own information, at no additional cost to the Owner.
- C. 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.

- D. 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.
- E. Measure and report all data on movements of all instrumentation monitoring points to the nearest 0.01 ft.
- F. Retain the services of Geotechnical Monitoring Consultant to monitor the geotechnical instrumentation specified herein, which includes and is not limited to vibration monitoring.
 - 1. The consultant shall be a Geotechnical Engineer registered in the Commonwealth of Massachusetts and shall have demonstrated at least five (5) years' experience and at least three (3) projects of similar type, size, and complexity including installation and monitoring of vibrations with seismographs.
 - 2. The Geotechnical Monitoring Consultant shall be approved by the Engineer and must be approved two (2) weeks prior to mobilization for construction.
 - 3. The Geotechnical Monitoring Consultant shall adhere to all methods and standards described in this Specification.
- G. Retain the services of a Surveyor to monitor the geotechnical instrumentation specified herein which includes and is not limited to building, structure, utility, ground, and excavation support system monitoring points.
 - 1. The Contractor's Surveyor shall be registered in the Commonwealth of Massachusetts and shall have demonstrated at least five (5) years' experience and at least three (3) projects of similar type, size, and complexity including installation and monitoring of surface vertical and horizontal displacement points.
 - 2. The Contractor's Surveyor shall be approved by the Engineer and must be approved two (2) weeks prior to construction.
 - 3. The Contractor's Surveyor shall adhere to all methods and standards described in this Specification.

PART 2 – PRODUCTS

2.1 DEFORMATION MONITORING POINTS

- A. Deformation monitoring points which include Building or Structure Monitoring Points (SMPs), and Ground Surface Monitoring Points (GMPs) 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 VIBRATION MONITORING

- A. Construction vibrations shall be monitored as described in the Contract Specifications 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.

2.3 UTILITY MONITORING POINTS

- A. Provide 2-inch PVC casing, threaded and coupled, as-needed.
- B. Provide No. 4 rebar, threaded and coupled, as-needed.
- C. Installation borehole shall be backfilled with cement-bentonite grout.

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. Building or Structure Monitoring Points (SMPs)
 - 1. SMPs shall be installed at the locations and depths as determined by the Engineer during site walks prior to construction.
 - 2. All SMPs shall have the horizontal as-built location determined to an accuracy 0.5-feet and the elevation to an accuracy of 0.01-feet.
- B. Utility Monitoring Points (UMPs)
 - 1. UMPs shall be installed at the locations and depths as determined by

the Engineer during site walks prior to construction.

2. Where necessary, the Contractor shall install the UMPs by the use of vacuum excavation exercising due diligence not to disturb or damage the utility being monitored and to minimize disruption and damage to adjacent areas.
3. The location of the utility in plan shall be determined and the borehole advanced to within a maximum of 2-feet above the utility. The Contractor shall be responsible for any damage to the utility during installation of the utility monitoring points. Drill casing may be used during the installation.
4. After completion of installation, the as-built location in horizontal position shall be determined to an accuracy of 1-foot and in elevation to an accuracy of 0.01-feet.

C. Ground Surface Monitoring Points (GMPs)

1. GMPs shall be installed at the locations and depths as determined by the Engineer during site walks prior to construction.
2. All GMPs shall have the horizontal as-built location determined to an accuracy of 0.5-feet and the elevation to an accuracy of 0.01-feet.

D. Seismographs

1. The seismograph shall be installed adjacent to the existing above grade structure nearest to the work. If there are no existing structures within 50 feet, the seismographs shall be installed on firm surfaces, at 25 and 50 feet from the work zone.
2. Vibration sensors shall be firmly mounted on the surface of concrete or asphalt, or firmly on undisturbed soil.
3. The daily report shall clearly describe the location of the seismograph relative to the work zone and the work performed on that date.

3.3 MONITORING

- A. 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.
1. Seismographs shall be set up to monitoring vibrations continuously during all excavation, backfill, and compaction and installation of

temporary earth support. One seismograph shall monitor vibrations, per a crew, and shall be located adjacent to the nearest building. Vibration levels shall not exceed the criteria indicated herein.

2. Ground surface, building deformation monitoring points, and Utility Monitoring Points shall be monitored twice a week for all points located within 100 feet from the edge of the excavation, during all excavation, backfill and compaction, unless otherwise directed by the Engineer or specified
- B. 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.
- C. 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.
 3. Survey data shall be depicted graphically on plots and submitted with the tabular results to show incremental and cumulative movement since the start of excavation.
- D. 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 as measured from the ground surface within the limits of the work zone or adjacent areas where vibrations are monitored.

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 as measured from the ground surface within the limits of the work zone or at other adjacent areas where vibrations are monitored.
- E. Criteria for "threshold" and "limiting" settlement of GMP's located on the sidewalk or paved roadway areas 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 inches.
- F. Criteria for "threshold" and "limiting" settlement of UMPs adjacent to the temporary lateral support systems have been established as follows:
- "Threshold" Settlement: No greater than 0.25 inches.
- "Limiting" Settlement: No greater than 0.50 inch.
- G. Criteria for "threshold" and "limiting" angular distortion (measure of building rotation due to vertical settlement) of SMP' on 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.
- H. 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).
 3. Movements of adjacent structures, utilities or other facilities are detected.
- I. 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.
 - J. 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 resuming construction.
 - K. These criteria are intended to establish a minimum basis for the Contractor's design and procedures and do not relieve the Contractor of its responsibility for preventing detrimental movements and damage to adjacent structures, utilities or other work.
 - L. The Contractor shall pay a penalty \$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.
 - M. 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.
 - N. 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 - Vibration Monitoring

METHOD OF MEASUREMENT:

Measurement for payment for Vibration Monitoring 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 for Vibration Monitoring, the Contractor shall furnish all labor, materials, instrumentation, tools, equipment, and incidentals required to perform all vibration 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 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 MANOLE, CATCH BASIN, OR OTHER STRUCTURE	EACH
2051.5	DISPOSAL OF EXISTING RAILROAD TIES	TON

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; modification to existing piles; and selective demolition.

1.2 RELATED DOCUMENTS

- A. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- B. Section 02590 – BRICK MASONRY
- E. Section 02160 – TEMPORARY EXCAVATION SUPPORT SYSTEMS
- F. Section 02080 – SOIL AND WASTE MANAGEMENT
- G. Section 02095 – TRANSPORTATION AND DISPOSAL OF SOIL AND FILL
- D. Section 03315 – GROUT

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:

- 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. Masonry Plugs and Bulkheads

1. For each permanent and temporary bulkhead and masonry 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. A jack hammer or sawcut 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.
- C. 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 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.
- D. Owner assumes no responsibility for condition of the utilities, structures, properties or other facilities to be selectively demolished.
- E. If materials suspected of containing hazardous or asbestos materials are encountered, do not disturb; immediately notify Engineer.
- F. 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 all active and inactive (temporarily not in use) sewer and drain services have been re-directed prior to abandonment. Perform CCTV inspection of gravity mains, building inspections and flow/dye testing to locate, observe and confirm that no known or unknown services remain connected. Any monetary losses or damage to facilities or property due to backups, flooding or loss of use because of the abandonment of an active line shall be the sole responsibility of the Contractor.
- B. 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.
- C. 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.
- D. 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.
- E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- F. 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. For the cutting and removing of existing railroad ties, Contractor to isolate, capture and dispose with the removed ties any sawdust generated from cutting.
- C. 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.

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 4 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 control density fill or compacted 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.
- G. Fill excavations with solid fill resulting from earth removal operations and/or with select borrow material in accordance with Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING. Final grade to be restored in kind unless otherwise noted.
- H. 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. Railroad ties shall be removed by neatly cutting to the dimensions required. Ties shall not be torn, shredded or otherwise damaged by

removal methods.

5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 6. Dispose of demolished items and materials promptly.
 7. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
 8. 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.
 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 water tightness 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.
- D. At locations where existing piles are to be reused to replace the existing sewer or drain, the Contractor shall verify that the wood pile is not deteriorating. If wood piles scheduled for reuse are found to be in good condition, the piles shall be trimmed and capped with a concrete pile cap as indicated in the Contract Drawings. If wood piles scheduled to remain in place are found to be deteriorating, the Contractor shall notify the Engineer immediately.

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 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 blocks, 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 handicap 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 handicap 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 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. Manholes, catch basins or other structures that are partially demolished or removed for the Contractor’s convenience, or not fully removed or demolished where indicated in the Contract Documents, will be at the Contractor’s expense and at no additional cost to the Owner.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Demolition and/or Removal of Lamp Hole, 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 for Demolition or Removal of 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 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 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; abandonment 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 2051.4 – 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; 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 4-ft below finished grade or to a greater extent to facilitate installation of adjacent work; 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 control density fill or

compacted sand; and incidental work not 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; disposal of construction debris as solid waste; demolition and removal of pipes, lamp holes, 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 – Disposal of Existing Railroad Ties

METHOD OF MEASUREMENT:

Measurement for payment for the Disposal of Existing Railroad Ties 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. Material 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 the Disposal of Existing Railroad Ties 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 existing railroad ties from the project right of way. The work includes, but is not limited to; handle, load, transport, and dispose at an appropriately permitted facility; 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 excavated and disposed with existing railroad ties due to poor segregation techniques shall be estimated by the Engineer and deducted from the total weight disposed. Bituminous Concrete and Cement Concrete weight excavated and disposed with existing railroad ties due to poor segregation techniques shall be estimated by the Engineer and deducted from the total weight disposed.

END OF SECTION 02051

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SECTION 02080

SOIL AND WASTE MANAGEMENT

2080.1 **OHM - SOIL AND WASTE MANAGEMENT** **LUMP SUM**

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. Contractor shall have demonstrated experience in excavation, handling, and management of soils, including characterization for off-site disposal.

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, Revision 1, Inman Square Intersection Safety Improvement Project, Cambridge, Massachusetts, dated January 30, 2019.
 - 2. 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.

- 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.
- F. 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.
- G. Excavation and management of project soils and groundwater shall be conducted in accordance with:
1. A Project-Specific Utility-related Release Abatement Measure (URAM) Plan to be prepared by the Owner's Licensed Site Professional (LSP) and submitted to MassDEP by the City of Cambridge; and
 2. "Oil and Hazardous Materials Findings and Soil Management Recommendations, Revision 1, Inman Square Intersection Safety Improvement Project" Kleinfelder Memorandum, dated January 30, 2019 and attached to these specifications.
- H. All work shall be conducted in compliance with the following Contractor-prepared plans. These plans may be combined as appropriate so long as all requirements of each Plan are incorporated and distinct.
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.
- I. For work conducted on private and public properties outside of the Rights of Way (ROW) of public roadways, additional requirements for soil testing, reuse, storage, and backfill apply, as described in this section. Excavated soil shall not be removed from the individual property until all excavation and backfill has been completed on that property. Soil shall be stored, if necessary, on the property from which it came until backfill is completed on that property. The Contractor shall reuse excavated soils as backfill within the same property from

which it originated. Under no circumstances shall surplus project soil be used as backfill on a property outside of the Right of Way unless the soil originated on that property. If surplus soil cannot be used on the same property, and is consistent with soil in the adjacent Right of Way, it may be used as backfill in the Right of Way within the project limits, subject to Engineer's Approval. If surplus soil cannot be used as backfill in the Right of Way, it shall, with the Engineer's approval, be combined with other surplus soils; in all instances it shall be reused or disposed of in accordance with the requirements of this section.

- J. For work conducted on properties outside of the public Rights of Way, the Contractor shall notify the Engineer if visual or olfactory evidence of contamination is observed in the soil on any property. The Contractor shall not collect samples for chemical testing from individual properties outside of the Right(s) of Way except as allowed by the Engineer.

1.4 DEFINITIONS

- A. Area of Contamination: For the purpose of managing soil classified as RCRA characteristic or listed hazardous waste, the area of contamination is the contiguous area within which the waste has been identified.
- B. 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.
- C. Excavation: The removal of materials encountered to the elevation and width limits indicated in the Contract Drawings, Specifications, or as directed by the Engineer.
- D. 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.
- E. 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.

- F. 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.

- G. Soil Classification Categories: Unless specifically stated otherwise terms used in this specification are as defined in the MCP, 310 CMR 40.0006. The following definitions and soil classifications apply to these specifications:
 1. (Class A) Any soil or fill material which has concentrations of chemicals < RCS-1 Reportable Concentrations established by 310 CMR 40.0300 and 40.1600.

Class A soils may be reused at the following types of facilities: Managed Fill Site (operating under an Administrative Consent Order (ACO) issued by MassDEP, unless otherwise approved by the owner); or a permitted landfill, provided that in all cases, the excavated soil analyte concentrations meet the acceptance criteria established by the facility and that disposal of soil at the receiving facility will not result in an exceedance of an RC applicable at the point of reuse/disposal and which would require notification of a release pursuant to 310 CMR 40.0300. Soils not exhibiting evidence of contamination or soils determined through laboratory chemical analysis to be Class A soils may also be reused in the area of excavation or elsewhere within Project limits as approved by the Owner's LSP.

Soil/fill with OHM concentrations equal to or greater than (\geq) RCS-1, but which have been confirmed by the Owner's LSP to contain asphalt as a result of historic road construction or filling operations, and therefore exempt from notification requirements, may be categorized as Class A at the discretion of the Owner's LSP.

Class A soil 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. Class A soil may be used in gravel processing facilities provided the soil

analytical data is comparable to materials being used by the facility and such use is approved by the Engineer.

Class A soil/fill which is reused or disposed of off-site shall be transported under a MassDEP Bureau of Waste Prevention Material Shipping Record & Log (MSR). Management of Class A soils shall be conducted in conformance with the MassDEP Similar Soils Provision Guidance – WSC#-13-500 (2014).

2. (Class B) Contaminated: Any soil or fill material which contains oil or hazardous materials (OHM) at concentrations \geq a release notification threshold established by 310 CMR 40.0300 and 40.1600.

Soils with OHM \geq RCS-1 resulting from exempt activities or meeting the definition of “background” per 310 CMR 40006, may be managed as Class A at the direction of the Owner’s LSP.

Any soils exhibiting 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. Potentially contaminated soils may be reused within the area of excavation without first performing laboratory analyses, with the approval of the Owner’s LSP. Potentially contaminated soils shall not be mixed with soils not exhibiting either petroleum or chemical odor or visual indications of oil or hazardous materials. Any excavated soil/fill material which is not reused within the area of excavation, must be characterized prior to reuse.

Following receipt of analytical results, Class B soil/fill shall be handled in accordance with the type and concentrations of OHM present in the soil/fill. Surplus soil/fill which may be contaminated shall be segregated by the Contractor. Soil/fill which has been staged and characterized can be reused within the area of excavation or elsewhere on site provided the material has been characterized by laboratory analysis and has equal or less contamination than the point where it is to be reused.

3. Class B soil which cannot be reused on site shall be reused off-site, recycled, or disposed of at a permitted facility. Subcategories of Class B, which establish off-site management requirements, 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 recycling at an asphalt batching plant and/or the specific licensing requirements for the proposed 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 asphalt batching acceptance criteria, but meet the criteria for regional thermal treatment facilities, and are not classified as a RCRA Hazardous Waste.
 - e. Class B-5: Soil and Fill that contain concentrations of contaminants that exceed in-state, lined and unlined landfill reuse criteria or which require removal to regional disposal facilities and which is 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 and which is not classified as a hazardous waste.
4. (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.

Soil having or suspected of having the characteristics of a hazardous waste or of containing a listed hazardous waste shall not be removed from the lateral limits of an excavation or staged at another location except at the direction of the Engineer. 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. Land disposal of hazardous soil is prohibited until the soil has been treated to meet Land Disposal Restrictions (LDR) standards pursuant to 40 CFR 268.48. This material must be transported to an out-of-state approved RCRA permitted

disposal or treatment facility under a Uniform Hazardous Waste Manifest. Land disposal following achievement of the Uniform Treatment Standards (UTS) shall be at a RCRA landfill.

- 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 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, including disposal and/or reuse of excavated soil and fill material.
- B. The Contractor's Environmental Professional shall characterize all excavated soil and fill material prior to off-site reuse or disposal; pre-excavation characterization may be conducted by the Contractor. 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.
- C. At a minimum, all surplus soils shall be analyzed for the following parameters:
 - 1. MCP 14 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);
 - 5. Polychlorinated biphenyls (PCBs) (EPA Method 8082); and
 - 6. pH, Ignitability, Reactive Sulfide, Reactive Cyanide, Specific Conductance.
- D. The Owner shall not be responsible for costs associated with additional soil characterization.
- E. Characterization of soil, fill, and unknown material for disposal/reuse purposes, including; field screening and soil management/segregation; temporary storage/staging; and laboratory analysis (as may be necessary for unknown materials and/or for compliance with receiving facility requirements).

All laboratory chemical analyses conducted shall utilize currently accepted U.S. EPA and applicable state agency analytical protocols and procedures. Laboratory chemical analysis reports shall meet MassDEP Compendium of Analytical Methods (CAM) requirements for analysis which have published CAM requirements. The MassDEP MCP Analytical Method Protocol Certification Form shall be provided by the Laboratory with all sample results. TCLP analysis shall be conducted for any analyte for which the RCRA "rule of twenty" is exceeded.

- F. Management of contaminated groundwater: If groundwater potentially impacted by OHM, based on visual or olfactory evidence, is encountered in the course of the work and dewatering is required, discharge permits, modification of discharge permits, and/or 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.

- G. 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, Toxic Substances Control Act (TSCA), 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. MassDEP Technical Update. Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil (2002);
 4. Department of Transportation (DOT) regulations 49 CFR, and state transportation licenses and permits;
 5. 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;
 6. NIOSH/OSHA/USCG/EPA: "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" October 1985, DHHS (NIOSH). Publ. No. 85-115;
 7. Department of Transportation training;
 8. U.S. Army Corps of Engineers Section 404 Programmatic General Permit, Commonwealth of Massachusetts;
 9. General Contractor's license;
 10. National Pollutant Discharge Elimination System (NPDES) Notice of Intent (NOI) to discharge and associated Construction General Permits, Remediation General Permits, and/or Dewatering General Permits;
 11. Regional and local Publicly Owned Treatment Works (POTW) pre-treatment and construction dewatering requirements and 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;
 16. The Contractor's Soil Management Plan (SMP) and Health and Safety Plan to protect the workers and the public;
 17. Massachusetts Division of Occupational Safety (DOS): The Removal, Containment or Encapsulation of Asbestos (453 CMR 6), including all clarifications, policy statements, etc.;
 18. Massachusetts Department of Environmental Protection: 310 CMR 7.00, 7.09, 7.15 and all related amendments and policy statements;
 19. MassDEP: Asbestos Cement Pipe Guidance Document (2011);
 20. MassDEP Technical Update: Considerations for Managing Contaminated Soil: RCRA Land Disposal Restrictions and Contained-In Determinations, August 2010;
 21. MassDEP Similar Soils Provision Guidance (2014); and
 22. MassDEP Interim Policy on the Re-Use of Soil for Large Reclamation Projects (COMM-15-01).
- 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 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. Contractor shall provide means of separating potentially contaminated material from the staging area ground surface to prevent the potential of cross-contamination. Separation method to be provided in accordance with 3.4(C).

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 has been adequately characterized and has been approved for acceptance at an off-site facility) or shall be staged at a location determined and secured by the Contractor pending sampling and analytical characterization by the Contractor's Environmental Professional prior to off-site reuse or disposal, with the exception of soil suspected of having the characteristics of a hazardous waste or of containing a listed hazardous waste. These soils shall not be removed from the Area of Contamination or staged at another location except at the direction of the Engineer. 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. Soil that has been characterized as a Remediation Waste must be either live loaded, stockpiled on-Site or stockpiled on a property owned and/or controlled by the Owner. Stockpiling of known Remediation Waste at an alternative location shall be conducted only with the approval from the Owner and the Owner's LSP
4. 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.
5. 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.
6. Soil/fill shall not be staged within 100 feet (30.5 meters) of a Reservoir or Area of Critical Environmental Concern.
7. 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.
8. Removing characterized on-site materials for off-site re-use or disposal.

9. 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.
 10. The Contractor shall manage unknown material separately and temporarily stage the material pending characterization.
- G. 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.
- H. The Contractor is responsible for identifying potential hazards at the site and reviewing existing information.

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 02095 - TRANSPORTATION AND DISPOSAL OF SOIL AND FILL
- F. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- G. Section 02140 – DEWATERING

1.7 EXISTING CONDITIONS

- A. Limited chemical characterization of soil has been conducted, the results of which are presented in the report referenced in Paragraph 1.2 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. Three (3) soil borings were advanced in or adjacent to the project area. Soil samples were collected from three (3) borings (B-1_0-1', B-2_1-2', B-3_3-4') for laboratory chemical analysis. Grab samples from these individual locations were analyzed for volatile organic compounds (VOC). A composite sample generated from the three

locations (IS_B-1-2-3) was analyzed for semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCB), MCP 14 metals, total petroleum hydrocarbons (TPH) and general chemistry.

2. Laboratory analysis of composite sample IS_B-1-2-3 identified lead above the MCP RCS-1 Reportable Concentration of 200 mg/kg, and above the “20 times rule” concentration of 100 mg/kg, indicating the potential for the soil to fail TCLP analysis and be classified as a characteristic hazardous waste. Naphthalene was also detected as a VOC above the MCP RCS-1 Reportable Concentration of 4 mg/kg in location B-1.
3. Other analytes were detected in one or more of the soil borings above laboratory reporting limits but at concentrations below RCS-1 limits. These analytes included barium, cadmium, chromium, nickel, vanadium, zinc, mercury, SVOCs, and TPH.

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. The Environmental Professional(s) shall have demonstrated experience in management of RCRA hazardous waste soils and groundwater.
- 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 or ACO numbers (as applicable), contact person, and address and telephone number that the Contractor utilizes for waste disposal. The Contractor shall provide copies of the permits/ACOs 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/or 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, prevention of contamination of excavated soil by trucks used for asphalt transport, separation of stockpiled materials from the staging area ground surface, 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);
 11. Procedures for consolidating (i.e., bulking) compatible materials for disposal; and
 12. Procedures for dewatering; testing, handling, treatment, and disposal/discharge of groundwater.

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 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 chemical or natural odors originating from the work area or soil/fill staging area. 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. The Contractor shall have materials on hand to implement control measures.

PART 2 – PRODUCTS

2.1 DUST AND VAPOR CONTROL

- A. Air monitoring shall include total dust testing using MIE, Inc. Miniram PDM-3 Dust Monitors, or like instruments. Air monitoring shall include monitoring for total volatile organic vapors using a MiniRAE Photoionization Detector of like instrument.

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 geotechnical results and could have been placed on site, but was not, due to Contractor delay (i.e. laboratory results were not available within ten (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 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". If soils have been staged off-site prior to sampling and are subsequently determined to be characteristically hazardous for lead, no stabilization treatment may occur; these soils shall be managed as hazardous waste.
- 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, including those of Class A soils, shall also be covered at times as directed by the Engineer.

- D. Excavated soil shall not be removed from a private property until all excavation and backfilling has been completed on that property. Soil shall be stored, if necessary, on the property from which it was excavated until backfill is completed on that property. The Contractor shall reuse excavated soils as backfill within the same property from which it originated. Under no circumstances shall surplus project soil be used as backfill on a property outside of the Right of Way unless the soil originated on that property. If surplus soil is generated that cannot be used on the same property, and is consistent with soil in the adjacent Right of Way, it may be used as backfill in the Right of Way within the project limits, subject to the Engineer's approval. If surplus soil cannot be used as backfill in the Right of Way, it shall, with the Engineer's approval, be combined with other surplus soils and reused or disposed of in accordance with the requirements of this section. The Contractor shall not collect samples for chemical testing from individual public or private properties outside of the Right of Way except as allowed by the Engineer.
- E. Excavated soil shall be managed such that it is not exposed to contamination following excavation. Equipment and supplies in contact with excavated soil shall be free of asphalt, petroleum products or other hazardous materials that could be transferred to soil. Vehicles used to transport asphalt shall not be used to transport soil except by permission of and following inspection by of the truck, 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. Oil and Hazardous Materials Findings and Soil Management Recommendations, Revision 1, Inman Square Intersection Safety Improvement Project, Cambridge, Massachusetts, performed by the Engineer during design, is appended to this section and includes a summary of analytical results.
- C. The Contractor may either perform independent sampling and pre-characterization of soil/fill strata to be encountered during construction in advance of excavation such that excavated soil can be 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): If soil/fill suspected of including asbestos-containing debris 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 PACM and to assess potential hazards and appropriate handling procedures. Prior to handling and removing the PACM, MassDEP shall be notified and approval for handling and disposal obtained. Discovery and management of PACM shall be documented as required in the SMP. Evidence of PACM includes but is not limited to the presence of suspect asbestos-containing building debris such as broken or crushed asbestos-cement (transite) piping, vinyl floor tiling, tar-based pipe wrap, roofing paper or paper-like insulation materials. Following MassDEP approval, such soil/fill shall be managed in accordance with applicable regulations. Soils shall be analyzed for OHM to determine appropriate disposal requirements, as required by the proposed disposal facility.

 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. MCP 14 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 asphalt or concrete, or 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 hay bales, concrete barriers, or functionally equivalent berm material. All wastes 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. Stockpiles shall be limited in size to approximately 500 cubic yards, unless approved by the Engineer. If, as a result of combining soil piles into larger volumes than 500 cubic yards, soil must be disposed of as a higher cost bid item than would otherwise be required, the Contractor shall be responsible for the additional cost.
- H. Excavated soil shall not be added to a stockpile after it has been sampled for characterization.
- I. 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's Site Health and Safety Officer shall keep accurate documentation of all air monitoring in accordance with the Contractor's Health and Safety Plan. Air monitoring data shall be made available to the Engineer or Owner upon request. At the direction of the Engineer, air monitoring may be limited to visual assessment for dust and odor monitoring; instrument monitoring may be required at any time by the Engineer, based on the results of visual and odor monitoring.
- B. During excavation and construction at depths of greater than 2 feet below ground surface, 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 by personnel trained to operate the air monitoring equipment, record measurements, and compare to actions limits established by the Contractor's Health and Safety Plan, 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 odors 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. 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. 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. 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.
- F. 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.

- G. 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.
- H. 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 (containing no per- and polyfluoroalkyl substances (PFAS)), 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.

END OF SECTION 02080

SECTION 02095

TRANSPORTATION AND DISPOSAL OF SOIL AND FILL

2095.1	OHM-DISPOSAL OF SOIL – LESS THAN RCS-1 (CLASS A)	TON
2095.2	OHM - DISPOSAL OF SOIL – DAILY COVER UNLINED LANDFILL (CLASS B-1)	TON
2095.3	OHM - DISPOSAL OF SOIL – DAILY COVER LINED LANDFILL (CLASS B-2)	TON
2095.4	OHM - DISPOSAL OF SOIL – NON-HAZARDOUS SOLID WASTE ASPHALT BATCHING (CLASS B-3)	TON
2095.5	OHM - DISPOSAL OF SOIL - NON-HAZARDOUS SOLID WASTE THERMAL TREATMENT (CLASS B-4)	TON
2095.6	OHM - DISPOSAL OF SOIL – NON-HAZARDOUS SOLID WASTE (CLASS B-5)	TON
2095.7	OHM - DISPOSAL OF SOIL WITH DEBRIS – NON-HAZARDOUS SOLID WASTE (CLASS B-6)	TON
2095.8	OHM - DISPOSAL OF SOIL – TREATMENT OF RCRA CHARACTERISTICALLY HAZARDOUS SOIL TO DE-CHARACTERIZE & DISPOSAL OF SOIL AS NON-HAZARDOUS WASTE (CLASS C-1)	TON
2095.9	OHM - DISPOSAL OF SOIL – RCRA HAZARDOUS WASTE (CLASS C-2)	TON
2095.10	OHM - DISPOSAL OF SPECIAL 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 02051 – DEMOLITION, MODIFICATION, AND ABANDONMENT
- E. Section 02080 – SOIL AND WASTE MANAGEMENT
- F. 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.
 - 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 weight slips and BOL summary sheets shall be provided to the Owner within ten (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.
5. Within fifteen (15) business days following off-site disposal of soil or fill materials at a disposal facility the Contractor shall submit Material Shipping Record or MCP Bill of Lading load log sheets signed by the facility.
6. Following disposal of all the soil represented by a Material Shipping Record or Bill of Lading, the Contractor shall submit that Material Shipping Record "Acknowledgment of Receipt by Receiving Facility" or Contractor shall arrange for receiving facility to electronically sign that Bill of Lading "Attestation of Disposal", as applicable, within sixty (60) days of shipment.

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, Bills of Lading and Material Shipping Records, and shall designate one person who shall be made available to sign all transportation documentation. The Engineer shall be responsible for obtaining the Owner'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 90 days of hazardous waste characterization. This notification shall take place a minimum of 30 days prior to the 90-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, tree stumps, brush, and grass cuttings will utilize trucks 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 or other solid waste 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, as required in the Code of Massachusetts Regulations (CMR) 310 CMR 40.0030, such as a Material Shipping Record, MassDEP Bill of Lading, or by a Uniform Hazardous Waste Manifest. Where paper documents are utilized, 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 02080 – SOIL AND WASTE MANAGEMENT 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 – Less than RCS-1 (Class A)

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of Soil –Less than RCS-1 (Class A) 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, that the disposal be paid for at the unit price bid for this item. The Contractor shall use due diligence to identify a reuse location that meets the criteria identified in Section 02080 (Item 1.4 Definitions). Payment for disposal of the material at a higher unit price item shall be made only if the Contractor provides written certification that a reuse location that meets the criteria is not available; and only if approved in writing by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for OHM - Disposal of Soil –Less than RCS-1 (Class A) 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 – Less than RCS-1 (Class A). The work includes, but is not limited to; handle, load, transport, and dispose at a facility in accordance with the facility’s acceptance criteria, all soil/fill which is unsuitable for on-site reuse and is defined as less than RCS-1; 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; 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 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. The Contractor shall use due diligence to identify a disposal facility that meets the criteria identified in Section 02080 (Item 1.4 Definitions). Payment for disposal of the material at a higher unit price item shall be made only if the Contractor provides written certification that a reuse location that meets the criteria is not available; and only if approved in writing by the Engineer.

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 level; 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 – 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. The Contractor shall use due diligence to identify a disposal facility that meets the criteria identified in Section 02080 (Item 1.4 Definitions). Payment for disposal of the material at a higher unit price item shall be made only if the Contractor provides written certification that a reuse location that meets the criteria is not available; and only if approved in writing by the Engineer.

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 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.

2095.4 – OHM - Disposal of Soil – Non-Hazardous Solid Waste Asphalt Batching (Class B-3)

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of Soil – Non-Hazardous Solid Waste Asphalt Batching (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. The Contractor shall use due diligence to identify a disposal facility that meets the criteria identified in Section 02080 (Item 1.4 Definitions). Payment for disposal of the material at a higher unit price item shall be made only if the Contractor provides written certification that a reuse location that meets the criteria is not available; and only if approved in writing by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for OHM - Disposal of Soil – Non-Hazardous Solid Waste Asphalt Batching (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 (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, 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.

2095.5 – 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. The Contractor shall use due diligence to identify a disposal facility that meets the criteria identified in Section 02080 (Item 1.4 Definitions). Payment for disposal of the material at a higher unit price item shall be made only if the Contractor provides written certification that a reuse location that meets the criteria is not available; and only if approved in writing by the Engineer.

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, 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.

2095.6 – OHM - Disposal of Soil – Non-Hazardous Solid Waste (Class B-5)

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of Soil – Non-Hazardous Solid Waste (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. The Contractor shall use due diligence to identify a disposal facility that meets the criteria identified in Section 02080 (Item 1.4 Definitions). Payment for disposal of the material at a higher unit price item shall be made only if the Contractor provides written certification that a reuse location that meets the criteria is not available; and only if approved in writing by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for OHM - Disposal of Soil – Non-Hazardous Solid Waste (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 (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, 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.

2095.7 – OHM - Disposal of Soil with Debris – Non-Hazardous Solid Waste (Class B-6)

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of Soil Debris – Non-Hazardous Solid Waste (Class B-6) 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 and physical 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. The Contractor shall use due diligence to identify a disposal facility that meets the criteria identified in Section 02080 (Item 1.4 Definitions). Payment for disposal of the material at a higher unit price item shall be made only if the Contractor provides written certification that a reuse location that meets the criteria is not available; and only if approved in writing by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for OHM - Disposal of Soil with Debris– Non-Hazardous Solid Waste (Class B-6) 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 with Debris– Non-Hazardous Solid Waste (Class B-6). 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, B-1, B-2, B-3, or 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.

2095.8 – OHM - Disposal of Soil – Treatment of RCRA Characteristically Hazardous Soil to De-Characterize and Disposal 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 – Treatment of RCRA Characteristically Hazardous Soil to De-Characterize and Dispose of as Non-Hazardous (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 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 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, B-1, B-2, B-3, B-4, B-5, or B-6 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.

2095.9 – 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 Uniform Hazardous Waste Manifest. 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, B-1, B-2, B-3, B-4, B-5, B-6 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.

2095.10 - OHM - Disposal of Special Waste

METHOD OF MEASUREMENT:

Measurement for Payment for OHM - Disposal of Special 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 Special 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 Special 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

SECTION 02100

SITE PREPARATION AND TREE PRUNING

2100.1	TREE PROTECTION AND MAINTENANCE	LUMP SUM
2100.2	STUMP REMOVAL	LUMP SUM

PART 1 – GENERAL

1.1 SUMMARY

- A. The work to be done under this section 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 Owner's Representative.
- B. 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.
- C. 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 Owner's Representative. 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.
- D. Work in this section includes the following:
 - 1. Tree Protection
 - 2. Preparation of a Tree Protection and Maintenance Plan and Work Schedule
 - 3. Hiring of a Certified Arborist for the Duration of the Construction Activity
 - 4. Developing a Plant Health Care Program
 - 5. Tree Pruning
 - 6. Tree Removal

7. Stump Removal
8. Subsurface Root Exploration

1.2 RELATED WORK

- A. Division 1 – General Requirements
- B. Section 01570 – Maintenance and Protection of Traffic
- C. Section 02210 – Earth Excavation, Backfill, Fill and Grading
- D. Section 02524 - Curbs, Walks and Driveways
- E. Section 02900 – Landscaping

1.3 GENERAL REQUIREMENTS

- A. Tree, stump and shrub removal: Remove City and private trees as specifically designated on the plans, as listed in this specification (see attached list of Urban Forestry work orders to be executed as part of this project) and as directed by the Owner's Representative. Trees to be removed shall be verified with the Owner's Representative prior to undertaking any work under this Item. Trees shall be completely removed, including stumps, and legally disposed of offsite. Existing tree pits shall be restored to existing conditions or as per the Contract Documents.
- B. Pruning: The Contractor shall prune City and private trees within the limit of work before and after construction under the direction of a Massachusetts Certified Arborist and only as directed by Owner's Representative. 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.
- C. 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 Owner's Representative. Do not close or obstruct streets, walks or other occupied or used facilities without permission from the Owner's Representative. Pruning operations shall include the specific pruning requests identified in this specification (see attached list of Urban Forestry work orders to be executed as part of this project).
- D. 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.

- E. 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.
- F. 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. Expose roots shall be covered promptly. Excavation of all tree wells shall be done entirely by hand.
- G. The Contractor shall take the utmost care to avoid unauthorized, unnecessary or improper wounding of City 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 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.
- H. The Contractor shall engage a board certified arborist with a **minimum of five (5) years of experience** including experience with supersonic air tools such as the “airspade” for the project.
- I. The work shall consist of the provision of all labor, materials, equipment, and transportation required to complete the pruning as required by the Owner's Representative 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. Attending initial site visit and assessment with City representatives
 2. Securing necessary permits and approvals before commencement of work
 3. Posting work areas for parking restrictions
 4. Securing police details, if necessary
 5. Marking work zones for traffic and pedestrian control
 6. Providing a schedule of work for City review and approval
 7. Meeting with City staff on a periodic basis (up to 5 meetings)
 8. Visual assessment of each tree to be pruned including the assessment of the need for airspading and/or tree root pruning
 9. Determination of pruning objectives
 10. Making pruning cuts and wound care
 11. Wood waste and debris consolidation & disposal

12. Site cleanup

1.4 QUALITY ASSURANCE

- A. 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 Owner's Representative and City Tree Warden.

1.5 SUBMITTALS

- A. Certification: Submit the Certification of the arborist to be performing the work.
- B. Tree Protection and Maintenance Plan, Plant Health Care Program and Work Schedule: submit for review and approval by the Owner's Representative and City Tree Warden at least two (2) weeks prior to beginning initial work on a project street.
- C. Product Data: Submit most recent printed information from manufacturers for:
 - 1. Tree Watering Bags (if required)
 - 2. Slow Release Fertilizer
- D. Samples: Submit samples of:
 - 1. Tree Trunk Wrapping
 - 2. Tree Protection Fencing
 - 3. Wood Chips
 - 4. Tree Watering Bags
- E. Shop Drawing/ Field Mock-Up: Submit for review and approval by the Owner's Representative and City Tree Warden:
 - 1. Tree Box. Owner's Representative to approve first tree box constructed prior to Contractor completing remaining boxes.

PART 2 – PRODUCTS

2.1 TREE BOX

- A. Tree Box shall be constructed from 2 in. x 4 in. lumber creating a box around the border of the tree pit with 2 in. x 4 in. lumber standing straight up at the corners and wrapped with orange snow fence. Fasteners as per detail.

2.2 TREE TRUNK WRAPPING PROTECTION LUMBER

- A. Tree Trunk Wrapping Protection Lumber shall 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.

2.3 TREE PROTECTION FENCING

- A. Tree Protection Fencing shall be new 4 ft. height orange snow fence.
- B. Stakes shall be 2" diameter black painted galvanized steel pipe or 2in. x 4in. stained lumber stock as approved by the Owner's Representative.

2.4 WOOD CHIPS

- A. Wood Chips shall conform to provisions of Wood Chip Mulch under Materials Section M6.04.3 of the MassDOT Standard Specifications.

2.5 WATER

- A. 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.

2.6 TREE WATERING BAGS

- A. Tree Watering Bags shall be 20 gallon, slow-release drip irrigation bags, made of UV treated polyethylene. Color: green.

PART 3 – EXECUTION

3.1 GENERAL

- A. Remove trees, shrubs, grass and other vegetation, improvements, or obstructions that interfere with installation of new construction and as required. Removal includes digging out stumps in their entirety and grubbing roots to at least 2.5 feet below existing grades shown on the Drawings.
- B. Prior to start of subsurface work, Contractor shall conduct project-wide pruning of existing trees and shrubs within the right-of-way.

3.2 SPECIAL REQUIREMENTS

- A. 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.

- B. 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”.

3.3 TREE, STUMP AND SHRUB REMOVAL

- A. Work to be done under this item shall conform to the relevant provisions of Section 101 Clearing and Grubbing of the MassDOT Standard Specifications.
- B. Trees to be removed shall be verified with the Owner's Representative prior to undertaking any work under this Item. Trees shall be completely removed, including stumps, and legally disposed of offsite. Existing tree pits shall be restored as sidewalk under the appropriate sidewalk item.

3.4 SITE REVIEW OF EVALUATION OF TREES AND POTENTIAL CONSTRUCTION RELATED IMPACTS TO ROOT SYSTEMS

- A. Prior to mobilization and construction operations, Contractor, Arborist, Owner's Representative 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 including those designated as "Special Mature Trees". Contractor to document the trees and strategy to receive type of Tree Protection and submit for Owner's Representative's approval.

3.5 PROTECTION OF EXISTING TREES AND IMPROVEMENTS

- A. 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 protected. Trees having a caliper under 20" dbh shall be wrapped with tree protection lumber. "Special Mature Trees", those trees with a caliper over 20" dbh, shall be wrapped with tree protection lumber and protected with a tree box. 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”.
- B. 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.

- C. Protect existing trees and other vegetation indicated to remain in place or outside of the clearing/grading limit lines.

3.6 TREE PROTECTION FENCING

- A. 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 Owner's Representative.
- B. 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.
- C. 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.
- D. 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.
- E. Owner's Representative 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.
- F. 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 Owner's Representative.
- G. If the Owner's Representative determines that trees are not being protected to the standards herein, Owner's Representative 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.

3.7 TEMPORARY ACCESS

- A. Temporary access within plant protection areas is permitted to perform construction operations as approved by the Owner's Representative. 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.

3.8 TREE PROTECTION AND AIR SPADING OF ROOTS FOR SPECIAL MATURE TREES

- A. The Contractor shall stake out the following in relation to "Existing mature trees" as identified as being greater than 20" dbh or as identified in the field by the City Arborist 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 Owner's Representative. 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.
- B. 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.
- C. 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 Owner's Representative.
- D. 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.
- E. 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 Owner's Representative'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".

- F. 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 Owner's Representative. 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. If tree roots will be exposed for a period of time longer than 1 week, the contractor shall install 2" depth of wood chip mulch.
- G. Once final cuts are completed by the Contractor's arborist with airspade and pruning tools, no mechanical excavation shall be allowed beyond the final cut line around the existing tree to remain.
- H. The Contractor shall install forms for sidewalks or install curbs, etc. in locations shown on the 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. Planting soils shall be hand placed over these areas as shown on drawings and as described in specifications.

3.9 GENERAL HORTICULTURAL TREE AND ROOT RELATIONSHIPS

- A. 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 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.
- B. 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.
- C. 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.
- D. 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."
- E. Soil is most vulnerable to compaction, and roots to damage, when the soil is wet.

3.10 ROOT PROTECTION

- A. Roots that cannot be avoided during construction for all other trees to remain shall be carefully and cleanly cut. Only hand methods for grubbing roots will be accepted inside drip lines of trees to be left standing. All pruning of any roots greater than 2" must be completed under the supervision of the City Arborist. Root pruning shall include application of root treatment or fertilizer as required. In order to minimize impacts to roots, Contractor shall uncover roots with air spade for all Special Mature Trees as identified under Section 3.8 of this specification. Additionally, the City Arborist may determine that certain significant roots of trees under 20" in diameter may also require the use of an air spade.
- B. 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.
- C. 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 mulch can be used for permanent cover.
- D. 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.

3.11 EXCAVATION WITHIN DRIP LINE

- A. 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 six inches (6") on the ground to protect the root systems.
- B. 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 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 Owner's Representative. Provide protection for roots over one inch (1") diameter cut during construction operations. Prune roots that are either cut or broken with a smooth, clean cut.

3.12 ROOT PRUNING

- A. 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.

3.13 ROOT SYSTEM EXPOSURE AND SUPPORT

- A. 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.

3.14 PRUNING SAFETY STANDARDS

- A. Tree pruning and airspading 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.
- B. The Contractor's certified arborist must be present at all times while tree pruning is performed.
- C. 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.

3.15 PRUNING OBJECTIVES

The pruning operation shall focus on the following types of pruning:

- A. 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.

- B. 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.
- C. Raising. Raising shall consist of selective pruning to provide vertical clearance. The intent of crown raising for this project will be the removal of all branches extending lower than fourteen (14) feet above a public roadway and eight (8) feet above a public sidewalk. This includes trees endangered by traffic re-routing as the result of construction operations, as well as trees over existing roadways and sidewalks which do not presently meet these height requirements. However, the level of pruning of each tree will be determined at the site walk with the Contractor, Contractor's arborist, Owner's Representative and City arborist. Additionally, any cuts to lateral branches over 4" as well as any questionable cuts will require the approval of the City arborist.
- D. 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.
- E. 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.
 - 1. During the First Three Years After Planting: A central leader or leaders (as most appropriate for the species and specimen) shall be developed by removing competing leaders and removing vigorously growing branches that compete with the selected leader(s). A strong scaffold branch structure shall be developed by selecting the primary scaffold branches. To improve the scaffold structure, branches that are crossing, have included bark or interfere with the scaffold branches shall be removed. Scaffold branches shall be properly spaced. For deciduous shade trees that will reach or exceed 40 ft (12.2 m) in height at maturity, the recommended spacing is approximately 18 in (457.2 mm). For smaller species, 6 to 8 in. (152.4 mm to 203.2 mm) would be adequate.
 - 2. Between Four and Six Years After Planting: The development of a good, structurally sound scaffold branch system should be continued by selective thinning of or on branches and removing dead, interfering, split and broken branches. Large-growing branches with narrow angles of attachment shall be removed from the trunk and canopy. The crown shall be raised for pedestrian clearance and vehicular clearance.

3.16 PRUNING PRACTICES

- A. The Contractor's certified arborist shall visually inspect each tree before commencing work.
- B. 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.
- C. 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. Spurs may be used to reach an injured climber or when removing a tree.
- D. 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.
- E. 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.
- F. 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.
- G. Heading shall be permitted only by the expressed permission of the City, when needed to reach a defined objective.
- H. Topping and lion tailing shall be considered unacceptable pruning practices.
- I. 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.
- J. When tracing wounds, only loose, damaged tissue should be removed. No other wound treatments shall be used.
- K. On mature trees the maximum diameter of any undesirable branch (dead, broken, rubbing, structurally unsound) that may be left shall not exceed 2 in. (50.8 mm).
- L. Pruning cuts shall be clean and smooth with the bark at the edge of the cut

firmly attached to the wood.

- M. Large or heavy branches that cannot be thrown clear shall be lowered on ropes to present injury to the tree and other property.
- N. Rope injury to trees from leading out heavy wood shall be avoided by using a cambium guard or installing a false crotch.

3.17 UTILITY CONSTRUCTION NEAR TREES

- A. Route utilities away from existing trees. Review re-routing with Owner's Representative. 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.

3.18 ACTIVITIES PROHIBITED WITHIN DRIP LINE

- A. 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 Drip line".

3.19 EQUIPMENT

- A. 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 Owner's Representative.
 - 1. 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.
 - 2. Two (2) chipper dump trucks with a minimum capacity of nine (9) cubic yards, with Contractor's name painted on each side.
 - 3. Two (2) wood chippers with a capacity for 16" diameter limbs.
 - 4. All relevant traffic control devices as prescribed by the Manual of Uniform Traffic Control Devices (MUTCD) of the U.S. Department of Transportation.
 - 5. Supersonic air tools such as the "airspade" for use on designated trees with root conflicts as designated by Owner's Representative.

3.20 PLANT HEALTH CARE PROGRAM

- A. Prior to mobilization and construction operations, Contractor's arborist to document and submit a strategy for maintaining the health of existing trees

within the project limits including strategies for watering and fertilizing as outlined below.

- B. Watering: Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
- C. 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.
- D. 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 Owner's Representative, drill holes 6" to 10" deep and place granular fertilizer at frequent spacing.

3.21 DAMAGE DUE TO CONSTRUCTION OPERATIONS

- A. 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 Owner's Representative, can be remedied by corrective pruning measures shall be addressed immediately.
- B. Owner's Representative shall engage an independent qualified Arborist to inspect the damaged trees and to make a determination on damage, sustainability, and remediation procedures.
- C. The Contractor shall strictly adhere to the independent Arborist's recommendations.
- D. Broken limbs shall be pruned according to industry standards.
- E. Wounds shall not be painted.
- F. The total cost of tree repair, including the cost of the independent Arborist, shall be borne by the Contractor.

3.22 TREE REPLACEMENT DUE TO DAMAGE

- A. 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.

- B. 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 Owner's Representative and the City.
- C. 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).
- D. 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.
- E. The total cost of tree replacement, including the cost of the tree and stump removal and the independent Arborist, shall be borne by the Contractor.

3.23 TEMPORARY REMOVAL OF SHRUBS AND TOPSOIL

- A. 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.

3.24 DISPOSAL OF WASTE MATERIALS

- A. 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.
- B. 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.

- C. 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.
- D. Site cleanup shall follow as closely as possible to the pruning operation.

3.25 POST-CONSTRUCTION CLEANUP

- A. 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, tree boxes and trunk protection, and other materials.

PART 4 – COMPENSATION

Item 2100.1 --- Tree Protection and Maintenance

METHOD OF MEASUREMENT:

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 Owner's Representative.

BASIS OF PAYMENT:

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, including tree box at Special Mature Trees; tree maintenance; root and branch pruning before construction begins; root and branch pruning after construction; 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; project-wide pruning; air spading of roots at trees; and removing, storing, maintaining and re-planting of targeted shrubs and plantings as specified or as otherwise required by the Owner's Representative or City arborist.

EXCLUSIONS AND SPECIAL NOTES:

Payment for tree removal shall not be paid for under this item and is paid for elsewhere.

Item 2100.2 --- Stump Removal

METHOD OF MEASUREMENT:

Measurement for payment for Stump Removal will be based each stump removed as required by the City Arborist and as indicated on the contract documents.

BASIS OF PAYMENT:

Payment for work under Stump Removal will be based on the unit 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 removal and disposal of stump and roots; coordination with overhead electric and other utilities for the removal of the tree; and any other work incidental to the removal of the stump.

EXCLUSIONS AND SPECIAL NOTES:

Payment for stump removal on private property shall not be paid for under this item.

END OF SECTION 02100

SECTION 02140

DEWATERING

2140.1 TREATMENT OF CONSTRUCTION DEWATERING DAY

PART 1 – GENERAL

1.1 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 discharge permit and other regulatory requirements. Work to be done as part of dewatering includes, but is not limited to:
 - a. Obtain necessary state, local and Federal discharge permits, including an MWRA Construction Site Dewatering Discharge Permit.
 - b. Lower the groundwater level within excavations to at least 2 feet below the bottom of the excavation.
 - c. Lower hydrostatic pressure.
 - d. Prevent surface and storm water from entering the excavation during construction.
 - e. Limit settlement of utilities and adjacent structures.
 - f. Implement erosion and sedimentation control measures for disposing of discharge water.
 - g. Provide treatment system to treat all water removed from excavations as required by discharge permits, 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.
 - h. Provide an Environmental Site Professional/Dewatering Specialist/Field Representative (hereinafter referred to as the Dewatering Professional) who will be responsible for dewatering, re-infiltration, treatment and discharge of dewatering flows as specified and in compliance with all applicable permits and regulations.

- i. Common dewatering methods include, but are not limited to, sump pumping, deep wells, well points, vacuum well points or any combinations thereof.
- j. Water removed from excavations shall be re-infiltrated to the ground if feasible. If re-infiltration is not feasible, treated water shall be discharged to the Massachusetts Water Resources Authority (MWRA) sewer system in accordance with an MWRA Construction Site Dewatering Discharge Permit to be obtained by the Contractor and other appropriate permit(s) and regulations. In no case shall dewatering flows be directly or indirectly released to surface waters or storm drains prior to settling of suspended solids and appropriate additional treatment. The Contractor is responsible for obtaining and paying for necessary permits.

1.2 RELATED SECTIONS

- A. Section 01300 – SUBMITTALS
- B. Section 02010 – SUBSURFACE INVESTIGATION
- C. Section 02160 – TEMPORARY EXCAVATION SUPPORT SYSTEMS
- D. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL, AND GRADING

1.3 SUBMITTALS

- A. Shop Drawing: Submit the following in accordance with Section 01300 – SUBMITTALS:
 - 1. Submit the following qualifications three weeks prior to the construction:
 - 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), and all other applicable regulations and permits including, but not limited to, requirements for equipment, monitoring, sampling and reporting.
 - b. Submit a generalized plan of actions at least two (2) weeks before operation of the groundwater control system to be implemented in the event that the Threshold and Limiting values for groundwater lowering have been reached.
 - c. Certificate of Design.
 - d. A list of equipment including, but not limited to, pumps, prime movers, and standby equipment.
 - e. A description of the proposed method of dewatering; water re-infiltration; containment; treatment and discharge; and installation, monitoring, maintenance, and system removal procedures.
 - f. A groundwater monitoring plan shall be developed by the Professional Engineer retained by the Contractor that designs the dewatering system. The monitoring plan shall address groundwater control within the excavations and address settlements of utilities and adjacent structures.
 - g. A description of erosion/sedimentation control measures, and methods of disposal of pumped water.
 - h. 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, midfluents 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 AVAILABLE SUBSURFACE INFORMATION

- A. Subsurface exploration data are provided as referenced in Section 02010.

1.5 QUALITY ASSURANCE

- A. Employ the services of a Dewatering Professional having the following qualifications: A Massachusetts Registered Professional Civil Engineer who has 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 the appropriate temporary support of excavation systems proposed by the Contractor including, but not limited to, trench boxes, soldier pile and lagging, timber sheeting support and secant pile support of excavation systems.
- B. The dewatering systems installer supervisor shall have a minimum of five (5) years' experience in installation of well points, deep wells, recharge systems, or equal systems.
- C. The Dewatering Professional responsible for day to day operation of the system shall have the following minimum qualifications:
 - 1. Completion of at least five (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.
 - 2. Valid certification from the Massachusetts Department of Environmental Protection (DEP) to operate the proposed treatment system.
- D. 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.
- E. 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.

- F. 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 baselines established and submitted to the Engineer, and the Dewatering Professional is on site and has begun the duties specified herein.
- B. Furnish, install, operate, and maintain dewatering, re-infiltration, 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 minimum capacity of 10,000 gallons, such that if pumping rates exceed discharge rates, additional 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 to not 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 without prior treatment and permits.

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 discharge and/or 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 and discharged under a MWRA Construction Site Dewatering Discharge Permit. The Contractor shall be responsible for seeking coverage under the appropriate MWRA Permit. At a minimum, the Contractor shall be prepared to comply with the permit influent/effluent testing requirements. 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 MWRA Construction Site Dewatering Discharge Permit obtained by the Contractor.
- 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 MWRA Construction Site Dewatering Discharge Permit, as applicable. The Contractor shall submit notifications and reports to the entities identified in the permit. Comply with pre-discharge notification, discharge reporting, notification of no discharge, and termination of discharge notification requirements; and respond to inquiries or correspondence from agencies regarding permit issues.
 - b. 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 MWRA 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 the Remedial Contract.
- 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 work day basis for treatment of dewatering, as measured by the Engineer. The Contractor shall be paid per work 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 be assumed to 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, analytical testing, permit preparation and filing, 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

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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.
 2. The location, configuration, design, construction and maintenance of the excavation support walls and internal bracing shall be the sole responsibility of the Contractor.
 3. 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. No vibratory or impact hammers will be used to install the excavation support system within this area. 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.
 4. 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.
 5. 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.
 6. 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 all claims, costs and damages that arise as a result of the work performed at no

additional cost to the Owner.

7. 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.
8. 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.
9. 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 at least 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 Professional Civil Engineer Registered in the Commonwealth of Massachusetts 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

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 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 system 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.
- G. Provide pre-construction surveys in accordance with Section 01390 – PRE-CONSTRUCTION SURVEY.

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 stability.
3. Limit movement of ground adjacent to the excavation support system to be within the allowable ground deformation as specified.
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 exploration data are provided as referenced in Section 02010.
- B. The Contractor shall notify the Engineer immediately if obstructions are 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.
- C. 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.

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

- 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. Driving by impact or vibratory hammers shall not be allowed. 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 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 hydraulically pushing each sheet piling to the required design depth. No impact or vibratory hammers will be allowed for installation of steel or timber sheeting on this project. 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 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.
- 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.
- 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 MONITORING

- A. As required by the Engineer.

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	GRAVEL BORROW (TYPE B)	CUBIC YARD
2210.4	UNCLASSIFIED EXCAVATION	CUBIC YARD
2210.5	ROADWAY EARTH EXCAVATION	CUBIC YARD
2210.6	EXCAVATION FOR SBSS FOR TREES IN PAVEMENT – TO DEPTH OF 4.5-FT BELOW FINISHED GRADE	CUBIC YARD
2210.7	EXCAVATION FOR PLANTING BEDS – TO DEPTH OF 3.5-FT BELOW FINISHED GRADE	CUBIC 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, DEP, EPA, OSHA, and other regulatory agencies having jurisdiction over the Work.
3. Provide materials for backfilling excavations as indicated and specified.
4. 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.
5. Test pits per the drawings and as directed by the Engineer.

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.
2. Backfill Materials: Submit grain size analysis and performed in accordance with ASTM D422 and compaction moisture density curve (ASTM D1557) 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 (MCP 14 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 500 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 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. 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.
 - 4. 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.

5. Blasting shall not be permitted.

B. Test Pit Logs

1. Prepare and submit a log of the existing conditions observed. Each test pit log shall be submitted as its own document. The following information shall be indicated on the log at a minimum:
 - a. Plan sketch indicating size, material, quantity, function, ownership and direction of flow for each structure and utility. Include a north arrow and approximate STA number.
 - b. Swing ties indicating the horizontal location of each structure, utility and duct bank. Where horizontal alignment is found to vary, swing ties shall be recorded at appropriate intervals.
 - c. Top and bottom elevations of each structure and utility, and the dimensions of any encasement. Where vertical elevations are found to vary, elevations shall be recorded at appropriate intervals.
 - d. Where test pits are conducted to establish a vertical corridor for a proposed pipeline through conflicting utilities, include a profile sketch indicating the vertical separation between utilities.
2. Submit photographs that document wide-angle and close-up views of the existing conditions observed.

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; ice or frozen material; 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 D6938 to the maximum dry density

determined by ASTM D1557, multiplied by 100.

- D. Proof Roll: Compaction to a firm and unyielding condition 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.
- E. Rock Excavation:
 - 1. Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42-inch wide bucket on track-mounted power excavator equivalent to Caterpillar Model 215, rated at not less than 90HP flywheel power and 30,000 lb. drawbar pull. Trenches in excess of 10 foot 0-inches in width and pits in excess of 30 feet 0-inches in either length or width are classified as open excavation.
 - 2. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted heavy-duty excavating equipment without drilling, blasting or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170HP flywheel power and developing 40,000 lb. break-out force (measured in accordance with SAE J732C).
 - 3. Determination of rock excavation classification will be made by the Engineer. Typical of materials classified as rock are boulders 1.0 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits. Intermittent drilling, blasting or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation. Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by Engineer. If the area to be excavated is preblasted prior to the excavation of overburden soils, the Engineer shall be notified at least two days in advance to allow observation of the preblast drilling by the Engineer in order to classify the excavation. Visual observation of the completed excavation may be made by the Engineer to modify the excavation classifications. Removal of rock excavation prior to classification by the Engineer shall be considered as earth excavation unless accepted by the Engineer in writing. Such excavation will be paid on the basis of contract unit rates for this classification.

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 Department of Public Works, the Cambridge Water Department, 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 or pavement 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 company to perform field and laboratory 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 PROJECT/SITE CONDITIONS

- A. Subsurface investigation data are available as referenced in Section 02010.

1.7 MATERIAL TESTING

- A. Moisture Density - One per source, except for crushed stone. Repeat the moisture density test for every 500 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 company, 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 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 linear 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. Adjacent to Structure Exteriors: Every 300 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.
- B. 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
½-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.
- B. 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 layer up to the bottom of the gravel subbase or landscaping layer.

- C. 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. As per MHD Standard Specifications for Highway and Bridges, as amended, M2.01.0, crushed stone shall consist of durable crushed rock or durable crushed gravel stone, angular in shape and free from structural defects, comparatively free of chemical decay, and free of any foreign material including, but not limited to ice and snow, sand, silt, clay, loam, or other deleterious or organic material
- B. Crushed stone shall be wrapped in filter fabric.
- C. The crushed stone shall be uniformly blended and shall conform to MHD Specification Designation, M2.01, and the following gradation requirements:

Sieve Size	Percent Passing by Weight M2.01.4 ¾ inch crushed stone
1-inch (25.4 mm)	100
¾-inch (19.05 mm)	90-100
5/8-inch (15.875 mm)	---
½-inch (12.7 mm)	10-50
3/8-inch (9.5 mm)	0-20
No. 4	0-5
No. 8	---

2.4 DENSE GRADED CRUSHED STONE

- A. As per MHD Standard Specifications for Highway and Bridges, as amended, M2.01.7, dense graded crushed stone shall consist of hard, durable fragments of stone. Dense graded crushed stone shall be angular in shape and free from structural defects, comparatively free of chemical decay, and free of any foreign material including, but not limited to ice and snow, sand, silt, clay,

plastic, loam, or other deleterious or organic material.

- B. The crushed stone shall be uniformly blended and shall conform to MHD Specification Designation, M2.01.7, and the following gradation requirements:

Sieve Size	Percent Passing by Weight M2.01.7 Dense Graded Crushed Stone
2-inch (50 mm)	100
1.5-inch (37.5 mm)	70-100
3/4-inch (19.0 mm)	50-85
No. 4 (4.75 mm)	30-55
No. 50	8-24
No. 200	3-10

2.5 CONTROLLED DENSITY FILL (CDF)

- A. Controlled density fill shall consist of a cementitious hard excavatable mixture of aggregate, Portland Cement conforming to ASTM C-150, Type II, and air entraining admixtures. Controlled density fill may have coarse and fine aggregate consisting of well graded crushed stone.
- B. Controlled density fill shall be a maximum of 100 psi, consist of no fly ash and shall have clean water free from oils, acid, and organic matter.
- C. Controlled density fill shall be of the type specified in MHD 1995 Standard Specifications for Highway and Bridges, as amended, Type 2E.
- D. Controlled density fill shall be used as trench backfill material in areas inaccessible to compaction equipment such as below existing utilities and in narrow excavations for structures or as directed by the Engineer.
- E. Controlled density fill shall also be used to fill abandoned utilities and around the excavation support systems as directed by the Engineer.

2.5 GRAVEL BORROW (TYPE B)

- A. As per MHD Standard Specifications for Highway and Bridges, as amended, M1.03.0, Gravel Borrow (Type B) shall consist of hard, durable stone and coarse sand free from trash, ice and snow, loam and clay, surface coatings, tree stumps, roots and other organic and deleterious matter.
- B. Gravel Borrow shall conform to MHD Specification Designation, M1.03.0

Type B and the following gradation requirements:

Sieve Size	Percent Passing by Weight
3-inch (76.2 mm)	100
½-inch (12.5 mm)	50-85
No. 50	8-28
No. 200	0-10

2.6 FILTER FABRIC

- A. Filter Fabric shall consist of a nonwoven fabric made from polypropylene or polyethylene filaments or yarns.
- B. Filter Fabric shall be inert to organic chemicals commonly encountered in the soil.
- C. Edges and ends of filter fabric shall overlap a minimum of two feet.
- D. Filter Fabric used as a drainage medium shall conform to MHD Specification Designation, M9.50.0 Type III and the following recommended property tests:

Property	Unit	Test Method	Minimum Value
Grab Strength	Lbs	ASTM D-4632	80
Grab Elongation	Percent	ASTM D-4632	15
Sewn Seam Strength	Lbs	ASTM D-4632	70
Puncture Strength	Lbs	ASTM D-4833	25
Trapezoid Tear Strength	Lbs	ASTM D-4533	25
Mullen Burst Strength	Psi	ASTM D-3786	130

- E. Filter Fabric used as a separation medium shall conform to MHD Specification Designation, M9.50.0 Type I and the following recommended property tests:

Property	Unit	Test Method	Minimum Value
Grab Strength	Lbs	ASTM D-4632	180
Grab Elongation	Percent	ASTM D-4632	15
Sewn Seam Strength	Lbs	ASTM D-4632	160
Puncture Strength	Lbs	ASTM D-4833	70
Trapezoid Tear Strength	Lbs	ASTM D-4533	70

Property	Unit	Test Method	Minimum Value
Mullen Burst Strength	Psi	ASTM D-3786	210

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.
- B. Gravel Subbase shall be graded in accordance with Massachusetts Highway Department (MHD) 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

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

- A. As directed by the Engineer, over-excavate any unacceptable materials below the subgrade, and replace with compacted Gravel Borrow.

- B. Utilize excavating equipment equipped with a toothless or smooth edged, excavating bucket to expose the pipe trench subgrade to minimize disturbance of the bearing surface.
- C. Proof roll the exposed subgrade below pipes and structures prior to backfilling and filling operation, or placing crushed stone or sand borrow.
- D. Proof roll to a firm and unyielding condition with a minimum of 4 passes of a vibratory plate compactor or double drum roller the exposed subgrade prior to backfilling and filling operation or placing soil-supported pipeline.
- E. 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.

3.4 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.

3.5 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.
 - 1. Conduct test pits in accordance with Specification Section 01500-1.7 TEST PITS.
 - 2. Record all information required under Part 1.2.B - Test Pit Logs of this Specification Section.
 - 3. Perform an instrument survey of all horizontal and vertical alignments.
 - 4. Photograph the existing conditions observed. Mark any utilities, structures or encasement that is difficult to discern with orange paint prior to photographing.
- 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.

3.6 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.

3.7 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.

3.8 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.

3.9 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.

3.10 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	Proof roll

Area	ASTM Density Degree of Compaction
Crushed stone	As specified herein
Sand Borrow	95%
Gravel subbase	95%
General backfill with CDF adjacent to structures	As specified herein
Trench backfill (on-site fill)	
- below pavements	95%
- below landscaped areas	90%
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.
- 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 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.

3.11 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.

3.12 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 placed 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 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 backfill under, and service lateral trench backfill within 3 feet of the large diameter (>18-inches) water transmission mains shall be quick-set CDF. Backfill shall be placed in appropriately sized lifts and on both sides of the transmission main simultaneously to ensure that all loads applied to the main by the backfill are properly balanced and that they do not exceed the safe load carrying capacity of the main at any time.
- E. 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.
- F. 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.
- G. 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.
- H. 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.

3.9 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.

3.10 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.

3.16 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.

3.17 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 computed volume in 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 excavation 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. Test pitting related to transferring existing water services to an existing water main are not paid for here and are paid for elsewhere.

Item 2210.2 - Controlled Density Fill for Backfill

METHOD OF MEASUREMENT:

Measurement for payment for Controlled 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 Controlled 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 Controlled Density Fill for Backfill. The work includes, but is not limited to; furnish and install controlled 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.

SPECIAL NOTES/EXCLUSIONS:

Controlled Density Fill used for the abandonment of pipes and structures will not be paid for under this item. Gravel subbase shall only be paid for work related to full depth roadway construction work outside trench limits.

Item 2210.3 – Gravel Borrow (Type b)

METHOD OF MEASUREMENT:

Measurement for payment for Gravel Borrow Type b shall be made on the basis of cubic yards placed during full depth construction between limits of proposed curbing as indicated elsewhere in the Construction Documents or as otherwise approved by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Gravel Borrow Type b 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 placement of Gravel Borrow Type b. The work includes, but is not limited to; furnish and install Gravel Borrow Type b where there is insufficient existing roadway base material and where required by the Engineer; material testing; compaction; and compaction testing.

SPECIAL NOTES/EXCLUSIONS:

Gravel Borrow Type b used as trench backfill and for sidewalk construction will not be paid for under this item and are covered under separate pay items. Gravel Borrow Type b shall only be paid for work related to full depth roadway construction work outside trench limits.

Item 2210.4 – Unclassified Excavation

METHOD OF MEASUREMENT:

Measurement for payment for Unclassified Excavation shall be made on the basis of cubic yards of bituminous pavement, concrete subbase, concrete, remnants of foundation walls or slabs, cobblestones, and railroad ties and tracks 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 bituminous pavement, concrete subbase, concrete, remnants of foundation walls or slabs, cobblestones, and railroad ties and tracks excavated to final grade. The work includes, but is not limited to; saw cutting, torch cutting and excavating bituminous pavement, concrete subbase, concrete, remnants of foundation walls or slabs, cobblestones, and railroad ties and tracks; 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 bituminous pavement, concrete subbase, concrete, remnants of foundation walls or slabs, cobblestones, and railroad ties and tracks excavated to final grade. The work includes, but is not limited to; saw cutting, torch cutting and excavating bituminous pavement, concrete subbase, concrete, remnants of foundation walls or slabs, cobblestones, and railroad ties and tracks; 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 or temporary 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. This item does include payment for removal of soil or gravel, as it is paid for elsewhere in the Contract Documents.

Item 2210.5 – Roadway Earth Excavation

METHOD OF MEASUREMENT:

Measurement for payment for Roadway Earth Excavation shall be made on the basis of cubic yards of gravel and soil, 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 gravel and soil excavated to final grade within limits of full depth construction. 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 Roadway Earth 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 gravel and other soils excavated to final grade. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavating gravel and soil; transporting material to/from soil staging area; reuse of existing gravel or soil suitable for 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 removal of asphalt, temporary asphalt, gravel and/or soil 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 Roadway Earth Excavation, as it is paid for elsewhere in the Contract Documents. This item does not include payment for removal of concrete, asphalt, and cobbles, as it is paid for elsewhere in the Contract Documents. This item does not include final grading of subbase and work related to cold planing, as it is paid for elsewhere in the Contract Documents. Excess or unsuitable Roadway Earth Excavation shall be disposed of under soil management and disposal items.

Item 2210.6 – Excavation for SBSS for Trees In Pavement – To Depth of 4.5-ft Below Finished Grade

Item 2210.7 – Excavation for Planting Beds – to Depth of 3.5-ft Below Finished Grade

METHOD OF MEASUREMENT:

Measurement for payment for Excavation for SBSS and Planting Beds shall be made on the basis of cubic yards of gravel and soil, 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 gravel and soil excavated to final grade within limits of specialty soil placement. 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 Excavation of SBSS and Planting Beds 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 gravel and other soils excavated to final grade. The work includes, but is not limited to; saw cutting bituminous and cement concrete; excavating gravel and soil; transporting material to/from soil staging area; 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 removal of asphalt, temporary asphalt, gravel and/or soil 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 excavation, transportation and disposal of Roadway Earth Excavation, as it is paid for elsewhere in the Contract Documents. This item does not include payment for removal of concrete, asphalt, and cobbles, as it is paid for elsewhere in the Contract Documents.

END OF SECTION 02210

SECTION 02252

MANHOLES

2252.1	TYPE 1 MANHOLE PRECAST 4-FOOT DIAMETER	EACH
2252.2	TYPE 4 MANHOLE PRECAST 4-FOOT DIAMETER	EACH
2252.3	TYPE 1 MANHOLE PRECAST 6-FOOT DIAMETER	EACH
2252.4	TYPE 7 MANHOLE PRECAST 3'x4'	EACH
2252.5	EXISTING DRAINAGE OR SEWER STRUCURE ADJUSTED	EACH

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Furnishing, installing, and testing of precast concrete sanitary sewer manholes and storm drain manholes, complete and in place, within the limits and to the lines and grades indicated.

1.2 RELATED TECHNICAL SECTION

- A. Section 00825A – SPECIAL CONDITIONS
- B. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- C. Section 02590 – BRICK MASONRY
- D. Section 03300 – CONCRETE
- E. Section 07160 – BITUMINOUS DAMPPROOFING

1.3 SUBMITTALS

A. Submit the following in accordance with 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 and flat slab manhole tops; joints and gaskets; and construction details, tolerances, and other information as required by the Owner.
3. Submit manufacturer's recommended installation procedures for informational purposes.

1.4 QUALITY CONTROL

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. Owner reserves right to inspect and test by independent services at manufacturer's plant or elsewhere at his own expense.
- C. Engineer reserves the right to direct the Contractor to use blank base and riser sections in lieu of sections with pre-cast holes, should unknown site conflicts require field cutting of concrete for the connection of laterals.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS, AND EQUIPMENT.
- B. Removed manhole fixtures must not be reused and shall be salvaged and delivered to the City of Cambridge Public Works storage yard unless directed by the Owner to dispose off site.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Precast Bases, Risers, and Tops:
 1. Except as otherwise indicated, precast reinforced concrete manhole bases and risers shall be 48 inches diameter with top sections of types indicated or as directed.
 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.
7. Manholes larger than 4 feet in diameter at the base shall be reduced in diameter to 4 feet at the top riser section unless noted otherwise on the plans.
8. Manhole tops of the flat slab type, where space restrictions exist or where directed, shall not be less than 8 inches thick and reinforced as indicated, and shall have an opening having a minimum inside diameter of 24 inches.
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 – BITUMINOUS DAMPPROOFING.

B. Concrete:

1. Cement shall be moderate heat-of-hydration Portland cement conforming to ASTM C150, latest revision, Type II. Absorption, determined by absorption test described in ASTM C478, latest revision, shall not exceed 8 percent of dry weight.
2. The concrete for precast manhole sections shall have an average strength of not less than 4,000 psi at 28 days. Strength shall be determined by tests on 6-inch by 12-inch vibrated test cylinders cured in the same manner as the manhole sections, cores cut from the manhole sections, or by other approved methods. Not less than two concrete strength tests shall be made for each 100 linear feet of manhole sections and the test results submitted to the Owner. 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:

1. All frames shall have a minimum clear opening of 24 inches.
2. 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 seasonable temperature changes.
3. Frames and Covers shall be Cast Iron, conforming to ASTM A48, Class 35B and as follows:
 - a. Castings to be free from scale, lumps, blisters and sandholes.
 - b. Machine contact surfaces to prevent rocking.
 - c. Thoroughly clean and hammer inspect.
4. Two pickhole cast 180° apart shall be closed loops to facilitate removing cover allowing manhole pick to “hook” the loops.
5. Frames and covers shall be similar to a style typified by East Jordan Iron Works Product #00211123 (cover) and Product #00211111 (frame) or approved equal.
6. Frames and covers shall be capable of withstanding AASHTO H-20 loading unless otherwise indicated or specified.
7. The Contractor shall furnish all manhole frames and covers conforming to the details shown on the drawings, or as herein specified. Frames and covers shall be of cast iron with diamond cover surface design. Manhole covers shall be machined to fit securely and evenly on the frame.
8. Covers for all structures shall have the word “SEWER”, “DRAIN” or other appropriate designation cast upon them.

D. Jointing:

1. Precast machine-made solid segments shall conform to ASTM C139.
2. 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.

3. 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:

<u>DESCRIPTION</u>	<u>SEALANT PROPERTY</u>
Base	Vulcanized Butyl Rubber
Percent of Solids	100%
Shore "A" Durameter:	
- Initial	10
- Aged	20
Adhesion to Clean Surfaces	Excellent
Temperature Range:	
- Application	-20° F to 120° F
- Service	-65° F to 200° F
Water Absorption after 14 days immersion:	Less than 5%
Chemical Resistance after 7 days immersion in 5% Potassium Hydroxide and 5% Hydrochloride Acid	Excellent
Resistance to Water and Organic Solvents	Excellent
Resistance to Shock, Heat, and Cold	Excellent
Color	Black
Shelf Life	Excellent
Elongation	
- Initial	30%
- 2 weeks at 190° 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° F

F. Grout for Sealing Joints:

1. Grout for sealing mortar-type joints or grouting field made pipe openings, shall be a non-shrink grout which shall be a factory-mixed ready-to-use product containing especially prepared aggregate, cement and sand and other components which will produce a mortar or 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.

G. Mortar for Brickwork:

1. Per Section 02590 – BRICK MASONRY

H. Brick

1. Per Section 02590 – BRICK MASONRY

- I. Bituminous Dampproofing
 - 1. Per Section - 07160 – BITUMINOUS DAMPPROOFING
- J. Flexible Seals
 - 1. Flexible manhole seals shall be:
 - a. New Lok Joint Flexible Sleeve by Interpace,
 - b. A-Lok Manhole Sleeve by L & L Concrete Products,
 - c. Press Wedge II by Pre-Seal Basket Corporation,
 - d. or approved equal.
 - 2. Field applied seals shall be similar to a style typified by Kor-N-Seal boot or an approved equal.
 - 3. Manhole sleeves, gaskets and sealants shall be furnished complete with lubricants, stainless steel stops, inserts, clamps, etc.

PART 3 – EXECUTION

3.1 PROCUREMENT

- A. In addition to riser sections identified in the pre-cast manufacturer's clock drawings, procure an additional one each of every nominal height of 4-ft diameter base section for use as blanks when field cutting openings for pipe connections.

3.2 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.

3.3 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 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.

3.4 INSTALLATION

- A. Manhole sections shall be installed level and plumb and set on 12 inches compacted crushed stone or gravel base as indicated on the Drawings.
- B. 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.
- 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.
- D. All holes in sections used for handling shall be thoroughly plugged with non-shrink grout.
- 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 brick and mortar or precast concrete risers as per Section 02590 – BRICK MASONRY. 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. Exterior surfaces of brick masonry shall be plastered with

1/2 inch of cement mortar.

- 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.
- G. Manhole inverts shall be brick masonry for sewer or concrete for drain 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.

3.5 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.

3.6 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° 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. Refer to Article 51 – “Leakage Tests” in Section 00825A – SPECIAL CONDITIONS.

2. If Leakage Test method consists of visual or Close Circuit Television Inspection, the contractor shall perform 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.

3.7 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 2252.1 --- Type 1 Manhole – Precast 4-foot Diameter

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, cleaning, and leakage testing/inspection of 4-foot diameter precast type 1 concrete manholes complete as indicated on the 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; removal of loop detectors; removal of brick, concrete, or bituminous sidewalk; 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; sanitary sewer and storm drain flow handling; removal of groundwater from the trench; handling groundwater and proper discharge; filter fabric as required; furnishing and placement of bedding, including compaction; precast manhole sections with frames, covers, masonry chimney, appurtenances, bench, and sanitary sewer (if applicable) pipe sleeve (if applicable); furnishing, placing and compacting suitable backfill soil; grade and compact gravel pavement sub-base; compaction testing; and all appurtenances and incidental work. Adjustment of the frame and cover to final grade, and any adjustments to intermediate grades, are included in this pay item.

METHOD OF MEASUREMENT:

Payment for Manhole – Precast 4-foot Diameter Type 1 shall be based on the Unit Price bid in the proposal. Measurement for payment shall be based on the actual number of complete and functional manholes as shown on the Contract Drawings or as directed by the Owner or Engineer. **Assume manholes to have a vertical depth of 8 feet as measured from inside bottom of base section to finished grade.**

Manholes 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.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: manholes of different diameters; drop manholes of the same diameter; disposal of bituminous concrete and construction debris; treatment of groundwater discharged under a Dewatering Permit; procurement of off-site common fill; procurement, installation, and compaction of CDF.

Item 2252.2 --- Type 4 Manhole – Precast 4-foot Diameter

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, cleaning, and leakage testing/inspection of 4-foot diameter precast type 4 concrete manholes complete as indicated on the 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; removal of loop detectors; removal of brick, concrete, or bituminous sidewalk; 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; sanitary sewer and storm drain flow handling; removal of groundwater from the trench; handling groundwater and proper discharge; filter fabric as required; furnishing and placement of bedding, including compaction; precast manhole sections with frames, covers, masonry chimney, appurtenances, bench, and sanitary sewer (if applicable) pipe sleeve (if applicable); furnishing, placing and compacting suitable backfill soil; grade and compact gravel pavement sub-base; compaction testing; and all appurtenances and incidental work. Adjustment of the frame and cover to final grade, and any adjustments to intermediate grades, are included in this pay item.

METHOD OF MEASUREMENT:

Payment for Manhole – Precast 4-foot Diameter Type 4 shall be based on the Unit Price bid in the proposal. Measurement for payment shall be based on the actual number of complete and functional manholes as shown on the Contract Drawings or as directed by the Owner or Engineer. **Assume manholes to have a vertical depth of 14 feet as measured from inside bottom of base section to finished grade.**

Manholes 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.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: manholes of different diameters; drop manholes of the same diameter; disposal of bituminous concrete and construction debris; treatment of groundwater discharged

under a Dewatering Permit; procurement of off-site common fill; procurement, installation, and compaction of CDF.

Item 2252.3 --- Type 1 Manhole – Precast 6-foot Diameter

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, cleaning, and leakage testing/inspection of 6-foot diameter precast concrete manholes complete as indicated on the 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; removal of loop detectors; removal of brick, concrete, or bituminous sidewalk; 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; sanitary sewer and storm drain flow handling; removal of groundwater from the trench; handling groundwater and proper discharge; filter fabric as required; furnishing and placement of bedding, including compaction; precast manhole sections with frames, covers, masonry chimney, appurtenances, bench, and sanitary sewer (if applicable) pipe sleeve (if applicable); furnishing, placing and compacting suitable backfill soil; grade and compact gravel pavement sub-base; compaction testing; and all appurtenances and incidental work. Adjustment of the frame and cover to final grade, and any adjustments to intermediate grades, are included in this pay item.

METHOD OF MEASUREMENT:

Payment for Manhole – Precast 6-foot Diameter shall be based on the Unit Price bid in the proposal. Measurement for payment shall be based on the actual number of complete and functional manholes as shown on the Contract Drawings or as directed by the Owner or Engineer. **Assume manholes to have a vertical depth of 13 feet as measured from inside bottom of base section to finished grade.**

Manholes 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.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: manholes of different diameters; drop manholes of the same diameter; disposal of bituminous concrete and construction debris; treatment of groundwater discharged under a Dewatering Permit; procurement of off-site common fill; procurement, installation, and compaction of CDF.

Item 2252.4 --- Type 7 Manhole – Precast 3’x4’

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, cleaning, and

leakage testing/inspection of 3'x4' precast type 7 concrete manholes complete as indicated on the 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; removal of loop detectors; removal of brick, concrete, or bituminous sidewalk; 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; sanitary sewer and storm drain flow handling; removal of groundwater from the trench; handling groundwater and proper discharge; filter fabric as required; furnishing and placement of bedding, including compaction; precast manhole sections with frames, covers, masonry chimney, appurtenances, bench, and sanitary sewer (if applicable) pipe sleeve (if applicable); furnishing, placing and compacting suitable backfill soil; grade and compact gravel pavement sub-base; compaction testing; and all appurtenances and incidental work. Adjustment of the frame and cover to final grade, and any adjustments to intermediate grades, are included in this pay item.

METHOD OF MEASUREMENT:

Payment for Manhole – Precast 3'x4' Type 7 shall be based on the Unit Price bid in the proposal. Measurement for payment shall be based on the actual number of complete and functional manholes as shown on the Contract Drawings or as directed by the Owner or Engineer. **Assume manholes to have a vertical depth of 8 feet as measured from inside bottom of base section to finished grade.**

Manholes 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.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: manholes of different diameters; drop manholes of the same diameter; disposal of bituminous concrete and construction debris; treatment of groundwater discharged under a Dewatering Permit; procurement of off-site common fill; procurement, installation, and compaction of CDF.

Item 2252.5 – Existing Drainage or Sewer Structure Adjusted

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, and inspection of adjusted frame and cover on existing manhole(s) complete as indicated on the 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; removal of brick, concrete, or bituminous sidewalk; excavation of bituminous concrete roadway; excavation; transporting material to/from soil staging area; protection of existing manhole; adjusting castings; masonry chimney; bituminous damp proofing (if applicable); furnishing, placing and compacting suitable backfill soil; grade and compact gravel pavement sub-base; compaction testing; and all appurtenances and incidental work.

METHOD OF MEASUREMENT:

Payment for Existing Drainage or Sewer Structure Adjusted shall be based on the Unit Price bid in the proposal. Measurement for payment shall be based on the actual number of complete and functional, manholes frames and covers adjusted as shown on the Contract Drawings or as directed by the Owner or Engineer.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: disposal of bituminous concrete and construction debris; procurement, installation, and compaction of CDF; frames and cover for proposed manholes; adjusting castings for paving.

END OF SECTION 02252

SECTION 02466

HELICAL PILES

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work shall consist of furnishing all necessary engineering and design services, supervision, labor, tools, materials, and equipment to perform all work necessary to provide a helical pile foundation system to support the public art structure.
- B. The Contractor shall install Helical Piles below the public art structure as shown on the project Drawings.
- C. Each pile shall be designed for the allowable tension and compression loads indicated on the project Drawings.

1.2 RELATED WORK

- A. Section 02010 – SUBSURFACE INVESTIGATION

1.3 QUALIFICATIONS OF THE HELICAL PILE CONTRACTOR

- A. The Helical Pile Contractor shall perform design and construction of Helical Piles and shall furnish all materials, labor, and supervision to perform the work. The Contractor shall be experienced, trained and certified by the helical pile manufacturer in the proper methods of design and installation of Helical Piles. The Contractor shall provide names of on-site personnel materially involved with the work, including those who carry documented certification from the helical pile manufacturer. At a minimum, these personnel shall include foreman, machine operator, and project engineer/manager.
- B. Installers currently approved for this work are:
 - Atlas Systems of New England
 - Helical Drilling, Inc. – Braintree, MA
- C. The Helical Pile Contractor shall not sublet the whole or any part of the contract without the express written permission of the Owner.

1.4 DEFINITIONS

- A. Contractor: The person/firm responsible for performing the Helical Pile work.

- B. Coupling: Central steel shaft connection means formed as integral part of the plain extension shaft material. For Type SS & RS Helical Piles, couplings are internal or external sleeves, or hot upset forged sockets.
- C. Coupling Bolt(s): High strength, structural steel fasteners used to connect Helical Pile segments together. For Type SS segments, the coupling bolt transfers axial load. For Type RS segments, the coupling bolts transfer both axial and torsional forces.
- D. Helical Extension: Helical Pile foundation component installed immediately following the lead or starter section, if required. This component consists of one or more helical plates welded to a central steel shaft of finite length. Function is to increase bearing area.
- E. Helix Plate: Generally round steel plate formed into a ramped spiral. The helical shape provides the means to install the helical pile, plus the plate transfers load to soil in end bearing. Helix plates are available in various diameters and thickness.
- F. Helical Pile: A bearing type foundation element consisting of a lead or starter section, helical extension (if so required by site conditions), plain extension section(s), and a pile cap. A.k.a. helical screw pile, screw pile, helical screw foundation.
- G. Installation Torque(T) : The resistance generated by a Helical Pile when installed into soil. The installation resistance is a function of the soil type, and size and shape of the various components of the Helical Pile.
- H. Lead Section: The first Helical Pile foundation component installed into the soil, consisting of single or multiple helix plates welded to a central steel shaft. A.k.a. Starter Section.
- I. Manufacturer: CHANCE Civil Construction, or approved equivalent manufacturer of helical piles.
- J. Round Shaft (RS): Round steel pipe central Shaft elements ranging in diameter from 4-1/2" to 10". A.k.a. Hollow Shaft (Type HS), Type T/C, Type PIF.
- K. Plain Extension: Central steel shaft segment without helix plates. It is installed following the installation of the lead section or helical extension (if used). The segments are connected with integral couplings and bolts. Plain extensions are used to extend the helix plates beyond the specified minimum depth and into competent load bearing stratum.
- L. Safety Factor: The ratio of the ultimate capacity to the working or design load used for the design of any structural element.
- M. Square Shaft (SS): Solid steel, round-cornered-Square central Shaft elements ranging in size from 2-1/2" to 3". A.k.a. Type SQ.
- N. Torque Strength Rating: The maximum torque energy that can be applied to the helical pile foundation during installation in soil, a.k.a. allowable, or safe torque.

1.5 ALLOWABLE TOLERANCES

- A. Centerline of Helical Piles shall not be more than 6 inches from indicated plan location.
- B. Helical Pile plumbness shall be within 2° of design alignment.
- C. Top elevation of Helical Pile shall be within +1 inch to -2 inches of the design vertical elevation.
- D. Any piles not installed with the above allowable tolerances shall be replaced at no additional cost to the Owner.
- E. The Contractor must reimburse the Owner for all charges from the Project Design Engineer for any time spent evaluating the affects of piles installed outside of allowable tolerances, including but not limited to the redesign of pile caps and grade beams, and the addition of new piles.

1.6 QUALITY ASSURANCE

- A. Helical Piles shall be installed by a contractor authorized by the helical pile manufacturer. These Contractors shall have satisfied the certification requirements relative to the technical aspects of the product and installation procedures as therein specified. Certification documents shall be provided upon request to the Owner or their representative.
- B. The Contractor shall employ an adequate number of skilled workers who are experienced in the necessary crafts and who are familiar with the specified requirements and methods needed for proper performance of the work of this specification.
- C. All Helical Piles shall be installed in the presence of a designated representative of the Owner unless said Owner informs the Contractor otherwise. The designated representative shall have the right of access to any and all field installation records and test reports.
- D. Helical Pile components as specified therein shall be manufactured by a facility whose quality systems comply with ISO (International Organization of Standards) 9001 requirements. Certificates of Registration denoting ISO Standards Number shall be presented upon request to the Owner or their representative.
- E. The Contractor shall provide a standard one-year warranty on materials and workmanship of the product.
- F. Design of Helical Piles shall be performed by a Professional Engineer licensed in Massachusetts.

- G. Tests and inspections of piles: Test and inspect piles as specified herein. In accordance with Chapter 17 of the Massachusetts State Building Code 9th edition, the Contractor's Engineer for the helical pile design is responsible for the structural testing and special inspection of the helical piles. Contractor's Engineer shall submit statement of special inspections and structural testing program.

1.7 DESIGN CRITERIA

- A. Helical Piles shall be designed to meet the specified loads and acceptance criteria below the structures shown on the drawings. The calculations and drawings required from the Contractor shall be submitted to the Owner for review and acceptance in accordance to Section 1.10 "Submittals".

- B. The allowable working load on the Helical Piles shall not exceed the following values:

1. For compression loads:

$$P_{\text{allowc}} = 0.4 * f_{y\text{shaft}} * A_{\text{shaft}}$$

Where: P_{allowc} = allowable working load in compression (kip)
 $f_{y\text{shaft}}$ = minimum yield strength of central steel shaft (ksi)
 A_{shaft} = area of central steel shaft (with corrosion allowance) (in.²)

2. For tension loads:

$$P_{\text{allowt}} = S_{\text{ut}} / \text{FS}$$

Where: P_{allowt} = allowable working load in tension (kip)
 S_{ut} = Min. ultimate tensile strength of central steel shaft segment (at coupling joint) (kip)
FS = factor of safety of 2

- C. The ultimate structural capacity shall be determined as:

1. For compression loads:

$$P_{\text{ultc}} = f_{y\text{shaft}} * A_{\text{shaft}}$$

Where: P_{ultc} = ultimate structural capacity in compression (kip)
 $f_{y\text{shaft}}$ = minimum yield strength of central steel shaft (ksi)
 A_{shaft} = area of central steel shaft (with corrosion allowance) (in.²)

2. For tension loads:

$$P_{\text{ultt}} = S_{\text{ut}}$$

Where: P_{ultt} = Ultimate structural capacity in tension (kip)

S_{ut} = Minimum ultimate tensile strength of central steel shaft (kip)

- D. Helical Pile capacity in soil shall not be relied upon from the following soil layers:
1. FILL MATERIAL
 2. ORGANIC MATERIAL (if encountered)
- E. Lateral Load and Bending: Where Helical Piles are subjected to lateral or base shear loads as indicated on the plans, the bending moment from said loads shall be determined using lateral load analysis program such as LPILE or equal commercially available software.
- F. Critical Buckling Load: Where Helical Piles are installed into low strength soil, the critical buckling load shall be determined using lateral load analysis program such as LPILE or equal commercially available software, or various other methods
- G. The Helical Pile attachment (pile cradle/cap) shall distribute the design load (DL) indicated on the project Drawings to the concrete foundation such that the concrete bearing stress does not exceed those in the ACI Building Code and the stresses in the steel plates/welds does not exceed AISC allowable stresses for steel members.
- H. Corrosion protection requirements for the various Helical Pile elements shall be provided by hot dip galvanization in conformance with ASTM A 123.

1.8 PROJECT/SITE CONDITIONS

- A. Subsurface Conditions: Refer to Section 02010

1.9 REFERENCED CODES AND STANDARDS

- A. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title, or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation. In case of conflict, the particular requirements of this specification shall prevail. The latest publication as of the issue of this specification shall govern, unless indicated otherwise.

1. American Society for Testing and Materials (ASTM):
 - a. ASTM A29/A29M Steel Bars, Carbon and Alloy, Hot-Wrought and Cold Finished.
 - b. ASTM A36/A36M Structural Steel.
 - c. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - d. ASTM A153 Zinc Coating (Hot Dip) on Iron and Steel Hardware.
 - e. ASTM A252 Welded and Seamless Steel Pipe Piles.

- f. ASTM A775 Electrostatic Epoxy Coating
 - g. ASTM A193/A193M Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service.
 - h. ASTM A320/A320M Alloy-Steel Bolting Materials for Low Temperature Service.
 - i. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - j. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - k. ASTM A513 Standard Specification for Electric Resistance Welded Carbon and Alloy Steel Mechanical Tubing.
 - l. ASTM A536 Standard Specifications for Ductile Iron Castings
 - m. ASTM A572 HSLA Columbium-Vanadium Steels of Structural Quality.
 - n. ASTM A618 Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.
 - o. ASTM A656 Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability.
 - p. ASTM A958 Standard Specification for Steel Castings, Carbon, and Alloy, with Tensile Requirements, Chemical Requirements Similar to Wrought Grades.
 - q. ASTM A1018 Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability.
 - r. ASTM D1143 Method of Testing Piles Under Static Axial Compressive Load.
 - s. ASTM D3689 Method of Testing Individual Piles Under Static Axial Tensile Load.
2. American Welding Society (AWS):
 - a. AWS D1.1 Structural Welding Code – Steel.
 - b. AWS D1.2 Structural Welding Code – Reinforcing Steel.
 3. American Society of Civil Engineers (ASCE):
 - a. ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations.
 4. Deep Foundations Institute (DFI):
 - a. *Guide to Drafting a Specification for High Capacity Drilled and Grouted Micropiles for Structural Support*, 1st Edition, Copyright 2001 by the Deep Foundation Institute (DFI).
 5. Society of Automotive Engineers (SAE):

- a. SAE J429 Mechanical and Material Requirements for Externally Threaded Fasteners.

1.10 SUBMITTALS

A. Construction Submittals

1. The Contractor or Contractor's Engineer shall prepare and submit to the Owner, for review and approval, working drawings and design calculations for the Helical Piles intended for use at least 14 calendar days prior to planned start of construction (but note also Paragraph 1.10.A.7). All submittals shall be signed and sealed by a Registered Professional Engineer currently licensed in the Commonwealth of Massachusetts.
2. The Contractor shall submit a detailed description of the construction procedures proposed for use to the Owner for review. This shall include a list of major equipment to be used.
3. The Working Drawings shall include the following:
 - a. Helical Pile number, location and pattern by assigned identification number
 - b. Helical Pile design load
 - c. Type and size of central steel shaft
 - d. Helix configuration (number and diameter of helix plates)
 - e. Minimum effective installation torque
 - f. Minimum overall length
 - g. Inclination of Helical Pile
 - h. Cut-off elevation
 - i. Helical Pile attachment to structure relative to pile cap.
 - j. Steel pile cap plate size, and thickness, and weld type to the pile.
4. The Contractor shall submit shop drawings for all Helical Pile components, including corrosion protection and pile top attachment to the Owner for review and approval. This includes Helical Pile lead/starter and extension section identification (manufacturer's catalog numbers).
5. The Contractor shall submit certified mill test reports for the central steel shaft, as the material is delivered, to the Owner for record purposes. The ultimate strength, yield strength, % elongation, and chemistry composition shall be provided.
6. The Contractor shall submit to the Owner copies of calibration reports for each torque indicator or torque motor to be used on the project. The calibration tests shall have been performed within forty five (45) working days of the date submitted. Helical Pile installation and testing shall not proceed until the Owner has received the calibration reports. These calibration reports shall include, but are not limited to, the following information:

- a. Name of project and Contractor
- b. Name of testing agency
- c. Identification (serial number) of device calibrated
- d. Description of calibrated testing equipment
- e. Date of calibration
- f. Calibration data

7. Work shall not begin until all the submittals have been received and approved by the Owner. The Contractor shall allow the Owner three weeks to review, comment, and return the submittal package after a complete set has been received. All costs associated with incomplete or unacceptable submittals shall be the responsibility of the Contractor.

B. Installation Records

1. The Contractor shall provide the Owner copies of Helical Pile installation records within 24 hours after each installation is completed. Formal copies shall be submitted on a weekly basis. These installation records shall include, but are not limited to, the following information.

- a. Name of project and Contractor
- b. Name of Contractor's supervisor during installation
- c. Date and time of installation
- d. Name and model of installation equipment
- e. Type of torque indicator used
- f. Location of Helical Pile by assigned identification number
- g. Actual Helical Pile type and configuration – including lead section (number and size of helix plates), number and type of extension sections (manufacturer's SKU numbers)
- h. Helical Pile installation duration and observations
- i. Total length of installed Helical Pile
- j. Cut-off elevation
- k. Inclination of Helical Pile
- l. Installation torque at one-foot intervals for the final 10 feet
- m. Comments pertaining to interruptions, obstructions, or other relevant information
- n. Rated load capacities

C. Closeout Submittals

1. Manufacturer's Warranty: Submit, for Owner's Acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights the Owner may have under Contract Document.

PART 2 - PRODUCTS

- 2.1 The Helical Pile components including, but not limited to, the central steel shaft, helical bearing plates, bolts, couplings, pile cap connections, and corrosion protection shall meet the minimum technical requirements developed by the approved Helical Supplier.

PART 3 – EXECUTION

3.1 Site Conditions

- A. All Helical Piles will be installed at the locations shown on the drawings.
- B. Prior to commencing Helical Pile installation, the Contractor shall inspect the work of all other trades and verify that all said work is completed to the point where Helical Piles may commence without restriction.
- C. The Contractor shall verify that all Helical Piles may be installed in accordance with all pertinent codes and regulations regarding such items as underground obstructions, right-of-way limitations, utilities, etc.
- D. In the event of a discrepancy, the Contractor shall notify the Owner. The Contractor shall not proceed with Helical Pile installation in areas of discrepancies until said discrepancies have been resolved. All costs associated with unresolved discrepancies shall be the responsibility of the Owner.

3.2 Installation Equipment

- A. Shall be rotary type, hydraulic power driven torque motor with clockwise and counter-clockwise rotation capabilities. The torque motor shall be capable of continuous adjustment to revolutions per minute (RPM's) during installation. Percussion drilling equipment shall not be permitted. The torque motor shall have torque capacity 15% greater than the torsional strength rating of the central steel shaft to be installed.
- B. Equipment shall be capable of applying adequate down pressure (crowd) and torque simultaneously to suit project soil conditions and load requirements. The equipment shall be capable of continuous position adjustment to maintain proper Helical Pile alignment.

3.3 Installation Tooling

- A. Shall consist of a Kelly Bar Adapter (KBA) and drive tools as manufactured by the helical pile manufacturer and used in accordance with the manufacturers written installation instructions.
- B. A torque indicator shall be used during Helical Pile installation. The torque indicator can be an integral part of the installation equipment or externally mounted in-line with the installation tooling. Torque indicators shall be as recommended by the helical pile manufacturer.

1. Shall be capable of providing continuous measurement of applied torque throughout the installation.
2. Shall be capable of torque measurements in increments of at least 500 ft-lb.
3. Shall be calibrated prior to start of work. Torque indicators which are an integral part of the installation equipment, shall be calibrated on-site. Torque indicators which are mounted in-line with the installation tooling, shall be calibrated either on-site or at an appropriately equipped test facility. Indicators that measure torque as a function of hydraulic pressure shall be calibrated at normal operating temperatures.
4. Shall be re-calibrated, if in the opinion of the Owner and/or Contractor reasonable doubt exists as to the accuracy of the torque measurements.

3.4 Installation Procedures

A. Central Steel Shaft: (Lead and Extension Sections)

1. The Helical Pile installation technique shall be such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project.
2. The lead section shall be positioned at the location as shown on the approved shop drawings. Battered Helical Piles can be positioned perpendicular to the ground to assist in initial advancement into the soil before the required batter angle shall be established. The Helical Pile sections shall be engaged and advanced into the soil in a smooth, continuous manner at a rate of rotation of 5 to 20 RPM's. Extension sections shall be provided to obtain the required minimum overall length and installation torque as shown on the working drawings. Connect sections together using coupling bolt(s) and nut torqued to 40 ft-lb.
3. Sufficient down pressure shall be applied to uniformly advance the Helical Pile sections approximately 3 inches per revolution. The rate of rotation and magnitude of down pressure shall be adjusted for different soil conditions and depths.

3.5 Termination Criteria

- A. The torque as measured during the installation shall not exceed the torsional strength rating of the central steel shaft.
- B. The minimum installation torque and minimum overall length criteria as shown on the Contractor's working drawings shall be satisfied prior to terminating the Helical Pile installation.

- C. If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to achieving the minimum overall length required, the Contractor shall have the following options:
1. Terminate the installation at the depth obtained subject to the review and acceptance of the Engineer and Owner, or:
 2. Remove the existing Helical Pile and install a new one with fewer and/or smaller diameter helix plates. The new helix configuration shall be subject to review and acceptance of the Owner. If re-installing in the same location, the top-most helix of the new Helical Pile shall be terminated at least (3) three feet beyond the terminating depth of the original Helical Pile.
- D. If the minimum installation torque as required is not achieved at the minimum overall length, and there is no maximum length constraint, the Contractor shall have the following options:
1. Install the Helical Pile deeper using additional extension sections, or:
 2. Remove the existing Helical Pile and install a new one with additional and/or larger diameter helix plates. The new helix configuration shall be subject to review and acceptance of the Owner. If re-installing in the same location, the top-most helix of the new Helical Pile shall be terminated at least (3) three feet beyond the terminating depth of the original Helical Pile.
 3. De-rate the load capacity of the Helical Pile and install additional Helical Pile(s). The de-rated capacity and additional Helical Pile location shall be subject to the review and acceptance of the Owner. Contractor shall reimburse owner for all costs of the Project Design Engineer for any foundation redesigns.
- E. If the Helical Pile is refused or deflected by a subsurface obstruction, the installation shall be terminated and the pile removed. The obstruction shall be removed, if feasible, and the Helical Pile re-installed. If the obstruction can't be removed, the Helical Pile shall be installed at an adjacent location, subject to review and acceptance of the Owner.
- F. If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to proper positioning of the last plain extension section relative to the final elevation, the Contractor may remove the last plain extension and replace it with a shorter length extension. If it is not feasible to remove the last plain extension, the Contractor may cut said extension shaft to the correct elevation. The Contractor shall not reverse (back-out) the Helical Pile to facilitate extension removal.
- G. The average torque for the last three feet of penetration shall be used as the basis of comparison with the minimum installation torque as required by the

Contractor's design. The average torque shall be defined as the average of the last three readings recorded at one-foot intervals.

PART 4 – COMPENSATION

Not Used

END OF SECTION 02466

SECTION 02500

PAVING AND SURFACING

2500.1	TEMPORARY HOT MIX ASPHALT (TRENCH WIDTH AND TEMPORARY RAMPS)	TON
2500.2	HOT MIX ASPHALT BASE COURSE – FULL WIDTH	TON
2500.3	HOT MIX ASPHALT INTERMEDIATE COURSE – FULL WIDTH	TON
2500.4	HOT MIX ASPHALT TOP COURSE – FULL WIDTH	TON
2500.5	HAND PLACED HOT MIX ASPHALT	TON
2500.6	COLD PLANE 2-IN, FULL WIDTH	SQUARE YARD
2500.7	FINE GRADING AND COMPACTING	SQUARE YARD
2500.8	HOT POURED RUBBERIZED ASPHALT SEALING	LINEAR FOOT
2500.9	HOT MIX ASPHALT INFRARED ASPHALT SEALING	LINEAR FOOT

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes the following:

1. Removal and replacement of existing bituminous pavement and subbase.
2. Installation of temporary pavement.
3. Installation of permanent trench and full-width pavement.
4. Removal and replacement of sidewalks, driveways, and aprons.

B. Furnish and install paving on all roadway areas as indicated and specified.

C. Pavement and surfacing shall be constructed in courses as shown on the plans and as required in accordance with these specifications and in close conformity with the lines, grades, compacted thickness and cross sections shown on the plans.

D. The Contractor shall take all reasonable measures to assure proper drainage on

the final surface of the roadway. Pavement that does not drain properly due to poor workmanship shall not be accepted by the Owner and shall be replaced by the Contractor at no additional cost to the Owner.

- E. Where required by the Engineer, the roadway surface shall be repaired by the infrared method. The repairs shall include the cleaning of the area, infrared heating, the addition of recycling agent and additional hot mix asphalt as required, raking to grade, compacting, and the addition of rejuvenating sealer with sand cover. The work shall be done in accordance with these Specifications and/or as required by the Engineer.
- F. Roadway restoration shall not proceed prior to acceptance of CCTV and testing of subsurface infrastructure by the Engineer and City.

1.2 RELATED WORK

- A. Division 1 – General Requirements
- B. Section 01200 – GENERAL REQUIREMENTS FOR UTILITY WORK
- C. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- D. Section 02524 – CURBS, WALKS AND DRIVEWAYS
- E. Section 02577 – PAVEMENT MARKINGS
- F. Section 03300 – CONCRETE

1.3 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. Reference is made herein to the MassDOT Highway Division, Standard Specifications for Highways and Bridges, latest edition, and all addendums/supplemental specs hereinafter referred to as the "Standard Specifications." All references to method of measurement, basis of payment, and payment items in the Standard Specifications are hereby deleted. References made to particular sections or paragraphs in the Standard Specifications shall include all related articles mentioned therein.

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with the General Conditions of Contract and Section 01300 – SUBMITTALS:
 - 1. Product Data: Provide copies of materials certificates signed by

material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

2. Design Data: Submit design mix for asphalt base, binder and surface course.

1.4 GRADE CONTROL

- A. Establish and maintain required lines and elevations.

1.5 QUALITY CONTROL

- A. Provide in accordance with Section 01400 and as specified.
- B. The Engineer may require the Contractor to remove at their own expense, any defective mix not conforming to the specified job mix formula within the stipulated tolerances. Samples of the actual mixture in use will be taken as many times daily as necessary and the mixtures shall be maintained uniform for the project. The Engineer may suspend further approval for use of the Plant mixtures if the mixtures do not conform to the specified requirements.
- C. Do not place materials when underlying surface is muddy, frozen, or has frost, snow, or water thereon.

1.6 PROJECT SITE CONDITIONS/PROJECT DESCRIPTION

In general, the following pavement repairs shall be made:

1. In areas where test pits or exploratory excavations occur, locations of temporary pavement, or where the road is to be reconstructed by others, a 4-inch temporary pavement is to be placed. When, and if, this material is disturbed during additional excavation work required for utility installation it shall be replaced. Excavations related to these activities shall be paved with temporary pavement on a weekly basis.
2. All road and streets shall be temporarily paved on a weekly basis.
3. Temporary driveway aprons and waterways shall be paved as part of the work.
4. The paving thicknesses specified above may be increased based on permit or field requirements.
5. Contractor to repair all potholes in project area once project commences. Payment for repair of potholes shall be considered incidental.

1.7 SEQUENCING AND SCHEDULING

- A. All roadway excavated areas shall be paved weekly with temporary trench pavement as specified. Paving on a weekly basis will be required unless permission not to do so is received from the applicable permit agency and Owner. Contractor shall pave any uneven surfaces at the end of each week. Temporary pavement shall be maintained a minimum of 90 days in local streets. The temporary pavement shall be repaired as necessary to maintain the surface of the pavement until replaced by permanent pavement.
- B. The Contractor shall provide temporary markings on the temporary pavements where existing markings are removed, at no additional cost to the Owner.
- C. Use of steel plates require the Contractor to notify the Owner's Public Works Department prior to use. If approved, steel plates shall be recessed into the roadway and welded as required.

1.8 GUARANTEE

- A. During the one-year guarantee period, the Contractor shall maintain the surfacing and shall promptly fill with similar material in compliance with the Specifications, any depressions and holes that may occur so as to keep the surfacing in a safe and satisfactory condition for traffic.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Subbase
 - 1. Materials including preparation of subgrades shall meet the requirements of the applicable sections of the Specifications, including Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
 - 2. The trench subbase shall be used in the upper 1-foot of trench backfill material immediately below pavements and graded in accordance with MassDOT Highway Division "Standard Specifications" Section M1.03.1 and applicable subsections of Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
- B. Hot Mix Asphalt Pavement – Base Course
 - 1. Asphalt Base Course and Asphalt Tack Coat shall conform to the applicable subsections of Section 460, Hot Mix Asphalt Pavement, of the MassDOT Highway Division's "Standard Specifications".
 - 2. Tack coat shall be RS-1 emulsion.
- C. Hot Mix Asphalt Pavement – Binder Course

1. Asphalt Binder Course shall conform to the applicable subsections of Section 460, Hot Mix Asphalt Pavement, of the MassDOT Highway Division's "Standard Specifications."
- D. Hot Mix Asphalt Pavement – Surface Course
1. Asphalt Surface Course shall conform to the applicable subsections of Section 460, Hot Mix Asphalt Pavement, of the MassDOT Highway Division's "Standard Specifications."
- E. Hot Poured Rubberized Asphalt Sealer
1. Hot Poured Rubberized Asphalt shall conform to Federal Specification Number SS-S-1401 as required in Section 460, Hot Mix Asphalt Pavement, of the MassDOT Highway Division's "Standard Specifications."

PART 3 – EXECUTION

3.1 GENERAL

- A. Pavement depths shall be as shown on the drawings or as specified herein.

3.2 TRANSPORTATION AND DELIVERY OF MIXTURES

- A. The mixtures shall be transported from the plant to the work in vehicles previously cleaned of all foreign materials. During transportation of the mixture from the plant to the spreader on the work, each load shall be covered at all times, without exception, with canvas or other suitable material of sufficient size and thickness to furnish complete protection. The mixture shall not be transported such a distance that segregation of the ingredients takes place or that any crust is formed on the surface, bottom or sides of said mixture which will not crumble or flatten out when the mixture is dumped or shall otherwise be deleterious to the mixture in place on the roadway.
- B. The vehicles for transporting shall be cleaned between uses of transportation of asphalt and soil.
- C. The vehicles for transporting the mixture shall be tight and inside of the bodies shall be evenly and lightly coated with suitable thin oil or approved soap solution, but no excess of lubricant shall be allowed to accumulate in low spots in the body.
- D. During paving operations, the Contractor shall provide continuous radio communication between the plant and the project to ensure immediate response due to breakdowns, emergencies such as accidents, and to insure the best quality results possible.

- E. When necessary, proper insulation of the vehicles transporting the mixture shall be made to ensure that the mixture is delivered for paving at the proper temperature.
- F. The dispatching of trucks from the plant shall be so arranged that all material which is to be delivered at or on the road surface during any day may be placed and shall have received final compaction before nightfall of the same day; unless artificial light, satisfactory to the Engineer is provided.
- G. The temperature of the mixture, within a tolerance plus or minus 15°, when delivered at the project site will be governed by the temperature of the base upon which the mix is placed as follows:

Base Temp °F on Which Mix is Placed	MAT THICKNESS					
	1/2"	3/4"	1"	1-1/2"	2"	3" or Greater
35-40				305	295	280
40-50			310	300	285	275
50-60		310	300	295	280	270
60-70	310	300	290	285	275	265
70-80	300	290	285	280	270	265
80-90	290	280	275	270	265	260
90+	290	275	270	265	260	255

3.3 SUBGRADE PREPARATION AND PROTECTION

- A. Bring subgrade to required grade as necessary, including dynamic compaction, prior to placing subbase material.
- B. As required by the Engineer, over-excavate on-site fill material and any unacceptable materials below the subgrade. Utilize excavating equipment equipped with a toothless or smooth edged, excavating bucket to expose the on-site fill material and unacceptable materials to avoid disturbance of the bearing surface.
- C. Proof roll the overexcavated subgrade prior to placing crushed stone.
- D. Prepare subgrade in accordance with Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
- E. Stabilize grades in accordance with Section 02210 so that loaded construction vehicles do not cause rutting or displacement when depositing materials.

3.4 PLACEMENT OF SUBBASE

- A. Do not begin placement of subbase and paving work until deficient subgrade areas have been corrected and are ready to receive paving.

- B. Subbase under roadway shall be installed and compacted as covered in the Contract Drawings and in Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
- C. The subbase to be placed under pavement shall be a minimum thickness as indicated on the Contract Documents after compaction. Subbase shall be evenly spread and thoroughly compacted in accordance with the Contract Documents.
- D. The subbase shall be spread in layers with thickness indicated on the Contract Documents. All layers shall be compacted to not less than 95 percent of the maximum dry density of the material as determined by ASTM D1557 Method C at optimum moisture content.
- E. Complete subbase preparation, including dynamic compaction, for full width before placing surfacing materials.

3.5 HOT MIX ASPHALT BASE COURSE

A. Weather Limitations

1. Apply prime and tack coats when ambient temperature is above 50 deg.F (10 deg.C), and when temperature has not been below 35 deg.F (1 deg.C) for 12 hours immediately prior to application. Do not apply when subbase is wet or contains an excess of moisture.
2. Base course pavement for temporary pavement may be placed when air temperature is above 30 deg.F (-1 deg.C) and rising.

B. Placement

1. Base course shall be spread and compacted to a finished thickness indicated on the Contract Drawings. A smooth even surface shall be produced.
2. Base course placement for temporary paving and trench paving shall be performed on a weekly basis or as otherwise approved by the Owner and Engineer. Cold Patch for temporary pavement shall not be allowed with the exception of in an emergency or to cover steel road plate edges.
3. Base course placed as temporary paving shall be maintained until removed prior to final paving.

3.6 HOT MIX ASPHALT SURFACE COURSE

A. Weather Limitations

1. Construct asphalt surface course when atmospheric temperature is

above 40 deg.F (4 deg.C) and when base is dry.

B. Placement

1. Surface course shall be spread and compacted, to the width required in the Contract Documents and to a finished thickness indicated in the Contract Documents. A smooth, even surface shall be produced. Full width overlays shall be installed after the street has been cold planed or as approved by the Owner and Engineer. Compact and finish pavement to provide a smooth transition between new and existing surfaces.
 - a. Prior to placement of the surface course, the entire surface which the surface course is to be placed shall be broom cleaned and tack coated.
 - b. Apply tack coat at a rate of 0.05 to 0.10 gallons per square yard over the base and binder courses. Apply material to penetrate and seal, but not flood, surface. Cure and dry as long as necessary to attain penetration and evaporation of volatile.

C. Placing Mix

1. Place hot mix asphalt mixture on prepared surface, spread and strike-off. Spread mixture at minimum temperature of 225 deg.F (107 deg.C). Place inaccessible and small areas by hand. Place each course to required grade, cross-section, and compacted thickness. Protect all adjacent construction from staining with mix or damage by mechanical equipment. Clean, repair or replace any construction stained or damaged at no additional cost to the Owner.
2. Place pavement in strips not less than 2-feet wide, unless otherwise acceptable to Engineer. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.
3. The Contractor shall supply an approved Dial Type Asphalt Thermometer (Range 10° C to 260° C) for each paving machine in operation on the project. The thermometer shall remain the property of the Contractor upon completion of the project.

D. Rolling

1. Begin rolling when mixture will bear roller weight without excessive displacement. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
2. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

3. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.
4. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density. Final rolling of the pavement shall be performed by a steel wheel roller weighing not less than 285 pounds per inch width of tread at a mix temperature and time sufficient to allow for final smoothing of the surface and thorough compaction.
5. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut-out such areas and fill with fresh, hot mix asphalt. Compact by rolling to match the surrounding surface density and smoothness.
6. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked by wheel traffic. Repair damages or other irregularities to satisfaction of Engineer, at no additional cost to the Owner, before final acceptance by the Engineer.
7. The Contractor shall furnish and install paving to provide transition or aprons for driveway and walkways impacted by new pavement installation.

E. Existing Pavement/Joints

1. The edges of existing pavement, which are to remain, shall be saw cut to even, straight edges. This includes road and trench edges. Any joints at junction of old and new pavements shall be sealed with an asphalt emulsion and covered with sand.
2. Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density and smoothness as other sections of asphalt course. Clean contact surfaces and apply tack coat.

F. Compaction

1. The asphalt mixture shall be compacted to at least 95% of the density achieved on the laboratory testing of the design mix for the project. Density will be checked by the Nuclear Density Gage Method, ASTM D2950. Testing shall be completed by Contractor at no expense to Owner for every 200 square yards of surface area placed.

G. Field Quality Control

1. Thickness: Test in-place asphalt courses for compliance with requirements for thickness. Repair or remove and replace unacceptable paving as required by Engineer, and at no additional cost to the Owner. In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:
 - a. Base or Binder Course: 1/4-inch, plus or minus.
 - b. Surface Course: 1/4-inch, plus or minus.

H. Crack Sealing

1. Crack sealing shall be performed where required by the Engineer with modified asphalts (e.g. hot poured rubberized asphalt sealer). Prior to sealing a crack all compressible material shall be removed by high-pressure air or routing. If grass or vegetation is present in the crack the Contractor shall 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.

I. Liquid Asphalt Emulsion

1. Liquid Asphalt Emulsion shall be applied prior to installation of asphalt as incidental to all pavement pay items. Emulsion shall be AC-20 conforming to AASHTO M226 and shall be applied at a temperature over 100 degrees F by an emulsion truck.
2. The emulsion truck shall have pneumatic tires of such width and number that the load produced on the surface shall not exceed 672 lbs/in of tire width, and it shall be designed, equipped, and operated so that at an even heat the emulsion may be applied uniformly on variable widths of surface at a readily controlled rate of 1/20 gal/square yard or as required by the Engineer.
3. The emulsion shall be applied within a pressure range of 25 psi to 75 psi. 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.

3.7 RAISING AND ADJUSTING CASTINGS

- A. Prior to base course or surface course paving, all existing or recently installed

City or Owner owned catch basin and manhole castings and curb and valve boxes shall be raised, if necessary, to the proper grade by the Contractor. The Contractor shall replace all gate valve boxes which are adjusted with boxes meeting the municipality standards unless the City or Owner agrees that the salvaged box is acceptable for reuse.

- B. Castings owned by private utilities shall be raised by the responsible utility. The Contractor shall be responsible for coordinating this work.
- C. The method of adjusting catch basin and manhole castings shall be as follows: Cut around catch basin or manhole castings a minimum of 8 inches from casting. Excavate and, if required, rebuild up to 12 inches of masonry below the bottom of the casting. Backfill with suitable material and compact to bottom of casting. Place high, early strength cement concrete or hot mix asphalt collar, as required by the Authority, to approximately 1½ inches below the raised casting grade. Masonry work shall conform to Section 02252 - MANHOLES and Section 02590 – BRICK MASONRY.
- D. The method of raising curb and valve boxes shall be as follows: Cut around valve box a minimum of 8 inches from valve box. Excavate as required and raise the valve box. Pour high early strength cement concrete or hot mix asphalt collar, as required, to approximately 1½ inches below the top of the valve box.
- E. Castings which need to be raised or adjusted to complete final surface course full-width paving shall be done immediately prior to paving.

3.8 EXCAVATION BY COLD PLANING

- A. The Contractor shall cold plane 2 inches as transitions onto the adjoining streets, and to the limits as established on the Plans. Cold planing shall be done after all excavation affecting the area is complete and prior to final paving.
- B. The Cold Planer shall be equipped with an elevating device capable of loading planed material directly into dump trucks while operative. The Cold Planer shall further have all necessary safety devices such as reflectors, headlights, taillights, flashing lights, and back-up signals so as to operate safely in traffic, both in the day or at 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 bituminous pavement. The Cold Planer shall be self-propelled and have the means for planing without tearing or gouging the underlying surface. The Cold Planer shall be adjustable as to crown and depth and shall meet the standards of the Air Quality Act for noise and air pollution.
- C. Variable lacing patterns shall be provided to permit a rough grooved surface as directed. A 2-inch cut is required in one (1) pass. The minimum width of pavement planed in each pass shall be 6-feet, except in areas to be trimmed and edged.
- D. The milled or planed surface shall conform generally to the existing grade and

cross slope. 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. Excess material shall be swept and removed so that the surface is acceptable to traffic.

3.9 HOT MIX ASPHALT INFRARED PAVEMENT SEALING

- A. Area to be repaired shall be swept clean to remove loose and foreign materials.
- B. An approved infrared heater shall be positioned over the area to be repaired for a period of time required to soften the existing pavement to a depth of two or more inches. Oxidation of the pavement caused by improper heating techniques shall be avoided. If this condition occurs, the oxidized pavement material shall be considered a defective material, and shall be disposed of and replaced in accordance with Article 16 and Article 20 of Section 00825 – SPECIAL CONDITIONS.
- C. The softened area shall have a minimum cutback of one foot on all sides of the excavation. The area shall then be scarified and sprayed with a liquid asphalt emulsion approved by the engineer, and raked to a workable condition.
- D. For trenches longer than 20 linear feet with jogs within 50 feet of each other, the contractor shall have a minimum cutback of one foot. The cutback shall be cut in a straight line consistent and equidistant from the opposite outside extremity of the one foot cutback trench line.
- E. For street crossings, no jogs are allowed. A one-foot cutback on each side from the widest section of the crossing, and uniform width throughout is required.
- F. Any additional hot mix asphalt required, shall be obtained from an engineer approved solid metallic heated asphalt storage unit. No hot mix asphalt, with a temperature of under 200 degrees F, shall be used.
- G. After the paving mixture has been properly admixed and raked to grade, compaction with a steel wheeled roller shall be required to establish a uniform density consistent to that of the adjacent surface within the work area. The finished patch shall be level with no depression retaining water on any of its surface.

PART 4 – COMPENSATION

Item 2500.1 --- Temporary Hot Mix Asphalt – (Trench Width and Temporary Ramps)

METHOD OF MEASUREMENT:

Measurement for Payment for Hot Mix Asphalt – (Trench Width and Temporary Ramps) shall be based on the tons of base course placed complete, to a maximum width defined by the payment limits shown on the Contract Drawings or as required by the Engineer and as

measured by the Engineer. Tonnage of pavement placed will be verified through calculation based on the actual thickness and trench widths and lengths or the pavement thicknesses, widths, and lengths defined in the Contract, whichever is less. The formula for calculating the tonnage of pavement shall be $W' \text{ (trench width)} \times L' \text{ (trench length)} \times D' \text{ (trench depth)} \times 0.075 \text{ ton/cf} = \text{tons}$. Calculated tonnage will be compared to the actual tonnage placed as submitted on pavement tonnage slips. If the tonnage calculated is greater than 10% lower than the tonnage on the pavement slips, the lesser tonnage shall be paid to the Contractor. Placement of pavement to excess thicknesses and outside the limits defined in the Contract Documents shall be at no additional cost to the Owner.

BASIS OF PAYMENT:

Payment for Hot Mix Asphalt – (Trench Width and Temporary Ramps) 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 to install hot mix asphalt base course within the limits of the trenches to depth and width indicated within the payment limits, complete, as shown in the Contract Documents or at the requirements of the Engineer. The work includes, but is not limited to the following; raising and resetting existing structures, castings and boxes; installation and compaction of hot mix asphalt base course to the depth and width and in the area specified; hand placement and compaction of hot mix asphalt around structures, aprons, driveways and as required; power sweeping; keyways and other jointing between new and existing asphalt; furnish and place tack coat on all edges; and all incidental work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

Items not included for payment herein include, but are not limited to; hot mix asphalt for permanent base course placed full roadway width and within trenches; hot mix asphalt for permanent surface course; hot mix asphalt porous pavement; and pavement installed to replaced asphalt damaged by the Contractor.

Item 2500.2--- Hot Mix Asphalt Base Course – Full Width

METHOD OF MEASUREMENT:

Measurement for Payment for Hot Mix Asphalt Base Course – Full Width shall be based on the tons of base course placed complete, to a maximum width defined by the payment limits shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer. Tonnage of pavement placed will be verified through calculation based on the actual thickness and roadway widths and lengths or the pavement thicknesses, widths, and lengths defined in the Contract, whichever is less. The formula for calculating the tonnage of pavement shall be $W' \text{ (trench width)} \times L' \text{ (trench length)} \times D' \text{ (trench depth)} \times 0.075 \text{ ton/cf} = \text{tons}$. Calculated tonnage will be compared to the actual tonnage placed as submitted on pavement tonnage slips. If the tonnage calculated is greater than 10% lower than the tonnage on the pavement slips, the lesser tonnage shall be paid to the Contractor. Placement of pavement to excess thicknesses and outside the limits defined in the Contract Documents shall be at no additional cost to the Owner.

BASIS OF PAYMENT:

Payment for Hot Mix Asphalt Base Course – Full Width 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 to install hot mix asphalt base course

full roadway width to depth and width indicated within the payment limits, complete, as shown in the Contract Documents or at the requirements of the Engineer. The work includes, but is not limited to the following; raising and resetting existing or recently installed structures, castings and boxes owned by the City or Owner; installation and compaction of hot mix asphalt base course to the depth and width and in the area specified; hand placement and compaction of hot mix asphalt around structures, aprons, driveways and as required; power sweeping; keyways and other jointing between new and existing asphalt; furnish and place tack coat on all edges; and all incidental work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

Items not included for payment herein include, but are not limited to; hot mix asphalt for temporary paving; hot mix asphalt for permanent base course placed within trenches; hot mix asphalt for permanent surface course; hot mix asphalt porous pavement; and pavement installed to replaced asphalt damaged by the Contractor.

Item 2500.3--- Hot Mix Asphalt Intermediate Course – Full Width

METHOD OF MEASUREMENT:

Measurement for Payment for Hot Mix Asphalt Intermediate Course – Full Width shall be based on the tons of intermediate (binder) course placed complete, to a maximum width defined by the payment limits shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer. Tonnage of pavement placed will be verified through calculation based on the actual thickness and roadway widths and lengths or the pavement thicknesses, widths, and lengths defined in the Contract, whichever is less. The formula for calculating the tonnage of pavement shall be $W' \text{ (trench width)} \times L' \text{ (trench length)} \times D' \text{ (trench depth)} \times 0.075 \text{ ton/cf} = \text{tons}$. Calculated tonnage will be compared to the actual tonnage placed as submitted on pavement tonnage slips. If the tonnage calculated is greater than 10% lower than the tonnage on the pavement slips, the lesser tonnage shall be paid to the Contractor. Placement of pavement to excess thicknesses and outside the limits defined in the Contract Documents shall be at no additional cost to the Owner.

BASIS OF PAYMENT:

Payment for Hot Mix Asphalt Intermediate Course – Full Width 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 to install hot mix asphalt base course full roadway width to depth and width indicated within the payment limits, complete, as shown in the Contract Documents or at the requirements of the Engineer. The work includes, but is not limited to the following; raising and resetting existing or recently installed structures, castings and boxes owned by the City or Owner; installation and compaction of hot mix asphalt base course to the depth and width and in the area specified; hand placement and compaction of hot mix asphalt around structures, aprons, driveways and as required; power sweeping; keyways and other jointing between new and existing asphalt; furnish and place tack coat on all edges; and all incidental work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

Items not included for payment herein include, but are not limited to; hot mix asphalt for temporary paving; hot mix asphalt for permanent base course placed within trenches; hot mix asphalt for permanent surface course; hot mix asphalt porous pavement; and pavement installed to replaced asphalt damaged by the Contractor.

Item 2500.4 --- Hot Mix Asphalt Top Course – Full Width

METHOD OF MEASUREMENT:

Measurement for Payment for Hot Mix Asphalt Top Course – Full Width shall be based on the tons of surface course placed complete, to a maximum width defined by the payment limits shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer. Tonnage of pavement placed will be verified through calculation based on the actual thickness and roadway widths and lengths or the pavement thicknesses, widths, and lengths defined in the Contract, whichever is less. The formula for calculating the tonnage of pavement shall be $W' \text{ (trench width)} \times L' \text{ (trench length)} \times D' \text{ (trench depth)} \times 0.075 \text{ ton/cf} = \text{tons}$. Calculated tonnage will be compared to the actual tonnage placed as submitted on pavement tonnage slips. If the tonnage calculated is greater than 10% lower than the tonnage on the pavement slips, the lesser tonnage shall be paid to the Contractor. Placement of pavement to excess thicknesses and outside the limits defined in the Contract Documents shall be at no additional cost to the Owner.

BASIS OF PAYMENT:

Payment for Hot Mix Asphalt Top Course – Full Width 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 to install hot mix asphalt surface course to depth and full roadway width, complete, as shown in the Contract Documents or at the direction of the Engineer. The work includes, but is not limited to the following; raising and resetting existing or recently installed structures, castings and boxes owned by the City or Owner; installation and compaction of hot mix asphalt surface course to the depth and width and in the area specified; hand placement and compaction of hot mix asphalt around structures, aprons, driveways and as required; power sweeping; keyways and other jointing between new and existing asphalt; furnish and place tack coat on all edges; and all incidental work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

Items not included for payment herein include, but are not limited to; hot mix asphalt for temporary paving; hot mix asphalt for permanent base course; hot mix asphalt porous pavement; and pavement installed to replaced asphalt damaged by the Contractor.

Item 2500.5 --- Hand Placed Hot Mix Asphalt

METHOD OF MEASUREMENT:

Measurement for Payment for Hand Placed Hot Mix Asphalt shall be based on the tons of hand placed hot mix asphalt placed complete, to limits as required by the Engineer or Owner and as measured by the Engineer. Tonnage of pavement paid will be calculated based on the actual thickness measured, width of placement measured and length of placement measured or the pavement thicknesses, widths, and lengths defined in the Contract, if appropriate, whichever is less. The formula for calculating the tonnage of pavement shall be $W' \text{ (trench width)} \times L' \text{ (trench length)} \times D' \text{ (trench depth)} \times 0.075 \text{ ton/cf} = \text{tons}$.

(trench length) x D' (trench depth) x 0.075 ton/cf = tons. Calculated tonnage will be compared to the actual tonnage placed as submitted on pavement tonnage slips. If the tonnage calculated is greater than 10% lower than the tonnage on the pavement slips, the lesser tonnage shall be paid to the Contractor. Placement of pavement to excess thicknesses and outside the limits defined in the Contract Documents or as required shall be at no additional cost to the Owner.

BASIS OF PAYMENT:

Payment for Hand Placed Hot Mix Asphalt 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 to install hand placed hot mix asphalt to depths, widths, and lengths required by the Owner or Engineer. The work includes, but is not limited to the following; raising and resetting existing structures, castings and boxes; hand placement and compaction of hot mix asphalt binder, base or surface course to the depth, width and length and in the area required by the Owner or Engineer; jointing between new and existing asphalt; furnish and place tack coat on all edges; and all incidental work not included for payment elsewhere.

This item shall include hand placed hot mix asphalt in locations where paving machines cannot maneuver. All locations of hand placement of hot mix asphalt shall be approved by the Engineer.

SPECIAL NOTES ON EXCLUSIONS:

This item is not used for temporary pavement at tree well locations and temporary ramps at pedestrian ramps or driveway aprons.

This item is NOT used for hand placement of hot mix asphalt in trenches or for other temporary conditions within the roadway or sidewalk including, but not limited to, temporary pavement at tree well locations. Hand placement of hot mix asphalt in trenches and for other uses of temporary placement shall be paid for under Item 2500.1. This item is NOT used for hand placement of hot mix asphalt under wire cut bricks. Hand placement of hot mix asphalt under wire cut bricks shall be considered incidental to the unit price bid for item 2524.4. This item is NOT used for hand placement of hot mix asphalt aprons around castings or other transitions after cold planning and before final paving. Hand placement of hot mix asphalt aprons around castings or other transitions after cold planning and before final paving shall be considered incidental to the unit price bid for item 2500.6. Hand placement of hot mix asphalt at driveways at the back of sidewalk are not paid for in this item and are paid for in Section 02950 – BACK OF SIDEWALK RESTORATION.

Item 2500.6 --- Cold Plane 2-Inch, Full Width

METHOD OF MEASUREMENT:

Measurement for the Cold Plane 2-Inch, Full Width will be based on the square yards of hot mix asphalt pavement cold planned to a depth of 2-inches, as measured by the Engineer to the payment limits described in the Contract Drawings and Specifications.

BASIS OF PAYMENT:

Payment for Cold Plane 2-Inch, Full Width 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 to cold plane 2-inches to the pay limits indicated on the Drawings and as specified. The work includes removing, hauling, stockpiling, and

disposing or reusing of cold planned asphalt material; sweeping after the cold planning operation; removal of asphalt from around existing or recently installed structures and castings owned by the City or Owner; providing transitions at the limits of the cold planning; providing and maintaining; temporary hot mix asphalt aprons at transitions and castings until final paving; maintaining the cold planned surface until final paving; providing temporary pavement markings, as required, until final paving; and all incidental work not included for payment elsewhere.

Item 2500.7 --- Fine Grading and Compacting Subbase

METHOD OF MEASUREMENT:

Measurement for the Fine Grading and Compacting Subbase will be based on the square yards of roadway sub-base graded to its final elevations, as measured by the Engineer to the payment limits described in the Contract Drawings and Specifications.

BASIS OF PAYMENT:

Payment for the Fine Grading and Compacting Subbase 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 to final grade the roadway sub-base, to the pay limits indicated on the Drawings and as specified. The work includes removing, hauling, stockpiling, and disposing or reusing of excess road sub-base; final grading; raising existing or recently installed castings owned by the City or Owner including frames and covers, frames and grates, curb boxes or gate boxes as required to achieve final grades; remove, stack, and reinstall existing wheel stops; replace damaged castings as required by the Owner or Engineer including damaged frames and covers; damaged frames and grates, damaged gate boxes and damaged curb boxes; layout by a professional land surveyor registered in the Commonwealth of Massachusetts of final grades, elevations and alignments; maintaining the graded sub-base until final paving; and all incidental work not included for payment elsewhere.

Item 2500.8 --- Hot Poured Rubberized Asphalt Sealer

METHOD OF MEASUREMENT:

Measurement for Hot Poured Rubberized Asphalt Sealer will be based on the linear foot of Hot Poured Rubberized Asphalt Sealer placed, as measured by the Engineer and where indicated on the Contract Drawings.

BASIS OF PAYMENT:

Payment for Hot Poured Rubberized Asphalt Sealer 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 to place Hot Poured Rubberized Asphalt Sealer where indicated on the Drawings and as specified. The work includes cleaning the surface prior to placing the sealer; prep all surfaces prior to placing the sealer; furnishing and placing the hot poured rubberized asphalt sealer; protecting areas where the sealer was installed; and all incidental work not included for payment elsewhere.

Item 2500.9 --- Hot Mix Asphalt Infrared Asphalt Sealing

METHOD OF MEASUREMENT:

Measurement for Payment for Hot Mix Asphalt Infrared Asphalt Sealing shall be based on the linear feet of Hot mix asphalt Infrared Asphalt Sealing performed complete, where shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for Hot Mix Asphalt Infrared Asphalt Sealing shall be based on the unit price bid for this item in the proposal. Under the Unit Price for Hot mix asphalt Infrared Asphalt Sealing, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to infrared pavement seal, where shown on the Contract Drawings, indicated in the Contract Specifications or at the requirements of the Engineer. The Work shall include; but is not limited to; cleaning and prepping joints prior to sealing the joint; removal and disposal of any surplus asphalt removed to provide an acceptable joint; furnish and install additional hot mix asphalt pavement as may be necessary to provide an acceptable joint; protecting the joint after sealing; and all incidental work required to infrared pavement seal all joints required, not included for payment elsewhere, whether stated here or not.

END OF SECTION 02500

SECTION 02510

HOT MIX ASPHALT POROUS PAVING

2510.1	HOT MIX ASPHALT POROUS PAVING	SQUARE YARD
2510.2	POROUS PAVING TRENCH EXCAVATION	CUBIC YARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor and each Subcontractor and/or supplier providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, titled "Related Documents."

1.2 SUMMARY

- A. Hot mix asphalt porous paving is an infiltration BMP used to store and treat stormwater runoff from the roadway. This system is designed with a subdrain that is connected to the City of Cambridge's stormwater system. It is not designed to infiltrate into the adjacent subsoils.
- B. Work in this Section includes the following:
 - 1. Subgrade Preparation
 - 2. Choker Course
 - 3. Reservoir Course
 - 4. Filter Medium Course
 - 5. Base Course
 - 6. Hot Mix Asphalt Porous Paving Course
 - 7. Subdrain
 - 8. Non-woven Geotextile Fabric
 - 9. Protection of Porous Media Beds During Construction
 - 10. Testing of Hot Mix Porous Asphalt Paving Mix by Independent Testing Company
 - 11. Maintenance of Porous Paving systems for one full (1) year following construction

1.3 RELATED WORK

- A. Section 01568 – EROSION CONTROL, SEDIMENTATION AND CONTAINMENT OF CONSTRUCTION MATERIALS
- B. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- C. Section 02622 – POLYVINYL CHLORIDE PIPE

1.4 PROJECT CONDITIONS

A. Protection of Existing Improvements:

1. Protect adjacent work from splashing of paving materials. Remove all stains from exposed surfaces of paving, structures, and grounds. Remove all waste and spillage.
2. Do not damage or disturb existing improvements or vegetation. Provide suitable protection where required before starting work and maintain protection throughout the course of the work.
3. Restore damaged improvements, including existing paving on or adjacent to the site that has been damaged as a result of construction work, to their original condition or repair as directed to the satisfaction of the Engineer, and authority having jurisdiction at no additional cost.

B. Safety and Traffic Control:

1. Notify and cooperate with local authorities and other organizations having jurisdiction when construction work will interfere with existing roads and traffic.
2. Provide temporary barriers, signs, warning lights, flaggers, and other protections as required to assure the safety of persons and vehicles around the construction area and to organize the smooth flow of traffic.

C. Weather Limitations:

1. **Hot Mix Asphalt Porous Paving shall not be placed between October 31 and May 1.** When it is in the public interest, only the Engineer or his/her agents may adjust the air temperature requirement or extend the dates of the paving season.
2. The material shall not be placed when the ambient air temperature at the paving site in the shade away from artificial heat is below 16° C (60° F) or when the actual ground temperature is below 10° C (50° F).
3. The Contractor shall not pave on days when the ground is damp or rain is forecast for the day unless a change in the weather results in favorable paving conditions as determined by the Engineer.

D. Protection of Porous Paving Beds

1. Porous pavement beds shall not be used for equipment or materials storage during construction, and under no circumstances shall vehicles be allowed to deposit soil on paved porous surfaces.
2. Contractor shall take any other necessary steps to prevent sediment from washing into beds during site development. When the site is fully stabilized, temporary sediment control devices shall be removed. For temporary sediment control devices refer to Section 01568 – EROSION CONTROL, SEDIMENTATION AND CONTAINMENT OF CONSTRUCTION MATERIALS.

1.5 GUARANTEE

- A. During the one-year guarantee period, the Contractor shall maintain the surfacing and shall promptly fill with similar material in compliance with the Specifications, any depressions and holes that may occur during that time period.

1.6 SUBMITTALS

- A. Submit a list of materials proposed for work under this Section including the name and address of the materials producer and the location from which the materials are to be obtained.
- B. Submit certificates, signed by the materials producer and the paving subcontractor, stating that materials meet or exceed the specified requirements.
- C. Submit samples of coarse aggregates and non-woven geotextile fabric for review and approval by the Owner's Representative.
- D. The asphalt mixing plant shall certify the aggregate mix, abrasion loss factor, polymer additive, binder draindown, tensile strength ratio, resistance to stripping by water and asphalt content in the mix.
- E. Submit name and contact information of company responsible for performing paving operations as soon as this information becomes available.

1.7 REFERENCES

- A. Annual Book of ASTM Standards, 1997 or latest edition; American Society for Testing and Materials, Philadelphia, PA.
- B. Commonwealth of MassDOT Highway Division: Standard Specifications for Highways and Bridges, 1988, or latest edition.
- C. University of New Hampshire Stormwater Center: Design Specifications for Porous Asphalt Pavement and Infiltration Beds, current edition.

PART 2 – PRODUCTS

2.1 CHOKER COURSE AND BASE COURSE

- A. All aggregates within the choker course and base course shall meet the following:
 - 1. Maximum Wash Loss of 0.5%
 - 2. Minimum Durability Index of 35

3. Maximum Abrasion of 10% for 100 revolutions and maximum of 50% for 500 revolutions
- B. Unless otherwise approved by the Engineer aggregate for the choker course and base course shall be uniformly graded with the following gradation (AASHTO size number 57):

<u>U.S. Standard Sieve Size</u>	<u>Percent Passing</u>
1 ½" (37.5mm)	100
1" (25mm)	95-100
½" (12.5mm)	25-60
#4 (4.75mm)	0-10
#8 (2.36mm)	0-5

2.2 RESERVOIR COURSE

- A. All aggregates within the reservoir course shall meet the following:
1. Maximum Wash Loss of 0.5%
 2. Minimum Durability Index of 35
 3. Maximum Abrasion of 10% for 100 revolutions and maximum of 50% for 500 revolutions
- B. Unless otherwise approved by the Engineer coarse aggregate for the gravel sub base course shall be uniformly graded with the following gradation (AASHTO size number 3):

<u>U.S. Standard Sieve Size</u>	<u>Percent Passing</u>
2 ½" (63mm)	100
2" (50mm)	90-100
1 ½" (37.5mm)	35-70
1" (25mm)	0-15
½" (12.5mm)	0-5

If the above gradation cannot be met, the following gradation (AASHTO size number 5) is acceptable with approval of the Engineer and a minimum void space of 40%:

<u>U.S. Standard Sieve Size</u>	<u>Percent Passing</u>
1 ½" (37.5mm)	100
1" (25mm)	90-100
¾" (19.0mm)	20-55
½" (12.5mm)	0-10
3/8" (9.5mm)	0-5

2.3 FILTER COURSE

- A. Filter course material shall have a hydraulic conductivity (also referred to as coefficient of permeability) of 10 to 60 ft/day at 95% standard proctor compaction unless otherwise approved by the Engineer. Do not over compact materials as this will result in the loss of

infiltration capacity. The hydraulic conductivity should be determined by ASTM D2434 and reported to the Engineer.

- B. Unless otherwise approved by the Engineer aggregate for the filter course shall be uniformly graded with the following gradation:

<u>U.S. Standard Sieve Size</u>	<u>Percent Passing</u>
6" (150mm)	100
#4 (4.75mm)	70-100
#200 (0.075mm)	0-6

2.4 NON-WOVEN GEOTEXTILE FABRIC

- A. Non-woven geotextile fabric shall meet the following properties:

<u>Mechanical Properties</u>	<u>Test Method</u>	<u>Unit</u>	<u>Minimum Average Roll Value</u>	
			<u>MD</u>	<u>CD</u>
Grab Tensile Strength	ASTM D 4632	kN (lbs)	0.71 (160)	0.71 (160)
Grab Tensile Elongation	ASTM D 4632	%	50	50
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.27 (60)	0.27 (60)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	2100 (305)	2100 (305)
Puncture Strength	ASTM D 4833	kN (lbs)	0.42 (95)	0.42 (95)
Apparent Opening Size (AOS)	ASTM D 4751	mm (U.S. Sieve)	0.212 (70)	0.212 (70)
Permittivity	ASTM D 4491	sec-1	1.4	
Permeability	ASTM D 4491	cm/sec	0.22	
Flow Rate	ASTM D 4491	l/min/m ²	4477 (110)	
			(gal/min/ft ²)	
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	70	
<u>Physical Properties</u>	<u>Test Method</u>	<u>Unit</u>	<u>Typical Value</u>	
Weight	ASTM D 5261	g/m ² (oz/yd ²)	217 (6.4)	
Thickness	ASTM D 5199	mm (mils)	1.9 (75)	
Roll Dimensions (w x l)	-	m (ft)	4.5 x 91 (15 x 300)	
Roll Area	-	m ² (yd ²)	418 (500)	
Estimated Roll Weight	-	kg (lb)	99 (217)	

2.5 HOT MIX ASPHALT POROUS PAVING COURSE

- A. Hot Mix Asphalt Porous Paving Mix shall conform to the Open-Graded Friction Course (OFGC) requirements of the MassDOT Highway Division Standard Specifications M3.11.00 with the exceptions as hereinafter noted.
- B. Hot mix asphalt porous paving shall be placed in one 4-inch layer as shown in the Contract Documents. **The hot mix asphalt porous paving may be placed in (2) 2-inch layers.**

- C. Contractor shall allow time for testing of porous paving mix by independent testing company at batch plant to assure conformance to project specifications.

2.6 SUBDRAIN

- A. Perforated pipe for use as a subdrain under the hot mix asphalt porous paving shall conform to Section 02622 – POLYVINYL CHLORIDE PIPE, 2.1 B (3).

PART 3 – EXECUTION

3.1 POROUS MEDIA BEDS

A. Grade Control:

1. Establish and maintain required lines and elevations. The Engineer shall be notified for review and approval of final stake lines for the work before construction work is to begin. Finished surfaces shall be true to grade and even, free of roller marks and free of puddle forming low spots. All areas must drain freely. Excavation elevations should be within +/-0.1 ft (+/- 3 cm).
2. If, in the opinion of the Engineer, based upon reports of the testing service and inspection, the quality of the work is below the standards which have been specified, additional work and testing will be required until satisfactory results are obtained.
3. The Engineer shall be notified at least 24 hours prior to all porous media bed and porous pavement work.

B. Subgrade Preparation:

1. Native subgrade refers to materials beyond the limit of the excavation. The existing native subgrade material under all bed areas shall be compacted to 98% standard proctor compaction prior to geotextile and stone bed placement.
2. Excavate subgrade to line, grade, and elevations indicated. Fill, regrade and compact to 98% standard Proctor any areas damaged by erosion, ponding, or traffic compaction before the placing of the stone subbase.
3. All bed bottoms shall be as level as feasible. For pavement subbases constructed on grade, soil or fabric barriers should be constructed along equal elevation for every 6-12” of grade change to act as internal check dams. This will prevent erosion within the subbase on slope.

C. Porous Media Bed Installation:

1. Subbase refers to materials below the pavement surface and above the native subgrade. Upon completion of subgrade work, the Engineer shall be notified and shall inspect at his/her discretion before proceeding with gravel bed installation.

2. All aggregates for use in the porous media bed shall be washed.
3. Geotextile and porous media bed aggregate shall be placed immediately after approval of subgrade preparation. Any accumulation of debris or sediment which has taken place after approval of subgrade shall be removed prior to installation of geotextile at no extra cost to the Owner.
4. Place geotextile in accordance with manufacturer's standards and recommendations. Adjacent strips of geotextile shall overlap a minimum of sixteen inches (16"). Secure geotextile at least four inches (4") outside of bed and take any steps necessary to prevent any runoff or sediment from entering the storage bed.
5. Install base course aggregate to a maximum 95% standard Proctor compaction. Install aggregate evenly to grades indicated on drawings.
6. Install filter course aggregate in 8 inch maximum lifts to a maximum 95% standard Proctor compaction. Lightly compact each layer with equipment, keeping equipment movement over storage bed subgrades to a minimum. Install aggregate to grades indicated on the drawings.
7. Install reservoir and choker course aggregates to a maximum 95% standard Proctor compaction. Reservoir course shall be placed evenly over surface of filter course. Choker course shall be placed evenly over surface of the reservoir course below it, sufficient to allow placement of the hot mix asphalt porous paving course and notify Engineer for approval. Choker course thickness shall be sufficient to allow for even placement of the porous paving but no less than 4 inches in depth.
8. The density of subbase courses shall be determined by AASHTO T 191 (Sand-Cone Method), AASHTO T 204 (Drive Cylinder Method), or AASHTO T 238 (Nuclear Methods), or other approved methods at the discretion of the supervising Engineer.
9. The infiltration rate of the compacted subbase shall be determined by ASTM D3385 or approved alternate at the discretion of the supervising Engineer. The infiltration rate shall be no less than 5-30 ft/day or 50% of the hydraulic conductivity (D2434) at 95% standard proctor compaction.
10. Compaction of subbase course material shall be done with a method and adequate water to meet the requirements. Rolling and shaping shall continue until required density is attained. Water shall be uniformly applied over the subbase course materials during compaction in the amount necessary for proper consolidation.
11. Rolling and shaping patterns shall begin on the lower side and progress to the higher side of the subbase course while lapping the roller passes parallel to the centerline. Rolling and shaping shall continue until each layer conforms to the required grade and cross-section and the surface is smooth and uniform.
12. Following placement of the subbase aggregate, the geotextile shall be folded back along all bed edges to protect from sediment washout along bed edges. At least a four

inch edge strip shall be used to protect beds from adjacent bare soil. This edge strip shall remain in place until all bare soils contiguous to beds are stabilized and vegetated. In addition, take any other necessary steps to prevent sediment from washing into beds during site development. When the site is fully stabilized, temporary sediment control devices shall be removed.

3.2 TESTING OF HMA POROUS PAVING COURSE DURING PRODUCTION

- A. The Contractor shall provide at Contractors' expense and the Engineer's approval an independent laboratory testing company to oversee and document mix production.
- B. The testing company shall test for the following:

<u>Test</u>	<u>Min. Frequency</u>	<u>Test Method</u>
Temperature in Truck at Plant	6 times per day	
Gradation	greater of either (a) 1 per 500 tons, (b) 2 per day, or (c) 3 per job	AASHTO T30
Binder Content	greater of either (a) 1 per 500 tons, (b) 2 per day, or (c) 3 per job	AASHTO T164
Air Void Content	greater of either (a) 1 per 500 tons, (b) 2 per day, or (c) 3 per job	ASTM D6752
Binder Draindown	greater of either (a) 1 per 500 tons, (b) 1 per day, or (c) 1 per job	ASTM D6390

If an analyzed sample is outside the testing tolerances immediate corrective action will be taken. After the corrective action has been taken the resulting mix will be sample and tested. If the re-sampled mix test values are outside of the tolerances the Engineer will be immediately informed. The Engineer may determine that it is in the best interest of the project that production is ceased. The Contractor will be responsible for all mix produced for the project.

- C. The paving mixture produced should not vary from the design criteria for aggregate gradation and binder content by more than the tolerances in the following table:

<u>U.S. Standard Sieve Size</u>	<u>Percent Passing</u>
¾" (19.0mm)	-
½" (12.5mm)	±6.0
3/8" (9.5mm)	±6.0
No. 4 (4.75mm)	±5.0
No. 8(2.36mm)	±4.0
No. 200(0.075mm)	±2.0
%PGAB	+0.4, -0.2

Should the paving mixture produced vary from the designated grading and asphalt content by more than the above tolerances, the appropriate production modifications are to be made until the hot mix asphalt porous paving mixture is within these tolerances.

Samples of the mixture, when tested in accordance with AASHTO T164 and T30, shall not vary from the grading proportions of the aggregate and binder content designated by the Engineer by more than the respective tolerances specified above and shall be within the limits specified for the design gradation.

- D. Should the hot mix asphalt porous paving mixture not meet the tolerances specified in this section upon repeat testing, the Engineer may reject further loads of mix. Mix that is loaded into trucks during the time that the plant is changing operations to comply with a failed test shall not be accepted, and should be recycled at the plant.

3.3 HOT MIX ASPHALT POROUS PAVING COURSE

- A. The mixing plant, hauling and placing equipment, and construction methods shall be in conformance with the applicable requirements of MassDOT Highway Division Standard Specifications Section M3.11.00, except as modified by this Section.
- B. The use of surge bins shall not be permitted.
- C. No mix shall be placed on wet or damp surfaces. When surface and ambient temperatures are 15 C and rising, the Contractor shall use mix prepared and placed in accordance with the specified requirements of the mix hereinbefore designated as Hot Mix Asphalt Porous Paving Course.
- D. Preparation of Bituminous Material. Mixing temperatures for OGFC shall be between 107 C and 121 C. A continuous supply of bituminous material shall be furnished to the mixer at a uniform temperature.
- E. Preparation of Aggregates. The aggregate for the mixture shall be dried and heated at the mixing plant before being placed in the mixer. Flames used for drying and heating shall be properly adjusted to avoid damaging the aggregate and depositing soot or unburned fuel on the aggregate. Mineral filler, if required to meet the grading requirements, shall be added in a manner approved by the Engineer after the aggregates have passed through the dryer. The above preparation of aggregates does not apply for drum-mix plants.
- F. Mixing. The dried aggregate shall be combined in the mixer in the amount of each fraction of aggregate required to meet the job-mix formula and thoroughly mixed prior to adding the bituminous material.
 - 1. The dried aggregates shall be combined with the bituminous material in such a manner as to produce a mixture that when discharged from the pugmill is at a target temperature in the range that corresponds to an asphalt cement viscosity of 700 to 900 centistokes and within a tolerance of ± 11 °C (± 20 °F).
 - 2. After the required quantity of aggregate and bituminous material has been introduced into the mixer, the materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate is secured. The mixing time will be regulated by the Engineer, and a suitable locking means shall be provided for these regulations.

3. All plants shall have a positive means of eliminating oversized and foreign material from being incorporated into the mixer.

- G. Hauling Equipment. Trucks used for hauling bituminous mixture shall have tight, clean, smooth metal bodies. The Contractor shall apply a thin coat of a non-petroleum based or soap solution to prevent the mixture from adhering to the bodies. Each truck shall have a cover of canvas or other suitable material of such size sufficient to protect the mixture from the weather. When necessary to ensure delivery of material at the specified temperature, truck bodies shall be insulated, and covers shall be securely fastened.
- H. Placing Equipment. The paver shall be a self-propelled unit with an activated screed or strike-off assembly, capable of being heated if necessary, and capable of spreading and finishing the mixture without segregation for the widths and thicknesses required. The screed shall be adjustable to provide the desired cross-sectional shape. The finished surface shall be of uniform texture and evenness and shall not show any indication of tearing, shoving, or pulling of the mixture. The machine shall, at all times, be in good mechanical condition and shall be operated by competent personnel.

Pavers shall be equipped with the necessary attachments, designed to operate electronically, for controlling the grade of the finished surface.

The adjustments and attachments of the paver will be checked and approved by the Engineer before placement of bituminous material.

Hot mix asphalt pavers shall be equipped with a sloped plate to produce a tapered edge at longitudinal joints. The sloped plate shall be attached to the paver screed extension.

The sloped plate shall produce a tapered edge having a face slope of 1:3 (vertical: horizontal). The plate shall be so constructed as to accommodate compacted mat thickness from 35 to 100 mm (1 1/4 to 4 inches). The bottom of the sloped plate shall be mounted 10 to 15 mm (3/8 to 1/2 inch) above the existing pavement. The plate shall be interchangeable on either side of the screed.

Pavers shall also be equipped with a joint heater capable of heating the longitudinal edge of the previously placed mat to a surface temperature of 95°C (200°F), or higher if necessary, to achieve bonding of the newly placed mat with the previously placed mat. This shall be done without undue breaking or fracturing of aggregate at the interface. The surface temperature shall be measured immediately behind the joint heater. The joint heater shall be equipped with automated controls that shut off the burners when the paving machine stops and reignite them with the forward movement of the paver. The joint heater shall heat the entire area of the previously placed wedge to the required temperature. Heating shall immediately precede placement of the bituminous material.

- I. Rollers. Rollers shall be in good mechanical condition, operated by competent personnel, capable of reversing without backlash, and operated at speeds slow enough to avoid displacement of the hot mix asphalt mixture. The mass (weight) of the rollers shall be sufficient to compact the mixture to the required density without crushing of the aggregate. Rollers shall be equipped with tanks and sprinkling bars for wetting the rolls. Rollers shall be two-axle tandem rollers with a gross mass (weight) of not less than 7 metric tons (8 tons) and not more than 10 metric tons (12 tons) and shall be capable of providing a minimum compactive effort of 44 kN/m (250 pounds per inch) of width of the drive roll. All rolls shall be at least 1 m (42 inches) in diameter.

A rubber tired roller will not be required on the open graded asphalt friction course surface.

- J. Conditioning of Existing Surface. Contact surfaces such as curbing, gutters, and manholes shall be painted with a thin, uniform coat of Type RS-1 emulsified asphalt immediately before the hot mix asphalt mixture is placed against them.

- K. Spreading and Finishing. Placing temperature shall be between 107°C and 121°C. As placing temperature is a critical factor in this type of mix, hauling time to the project should be limited so as to avoid mix temperature from dropping below the required minimum. All mixes should be covered during transportation.

The Contractor shall protect all exposed surfaces that are not to be treated from damage during all phases of the paving operation.

The hot mix asphalt mixture shall be spread and finished with the specified equipment. The mixture shall be struck off in a uniform layer to the full width required and of such depth that each course, when compacted, has the required thickness and conforms to the grade and elevation specified. Paver shall be used to distribute the mixture over the entire width or over such partial width as practical. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture shall be spread, raked, and luted by hand tools.

No material shall be produced so late in the day as to prohibit the completion of spreading and compaction of the mixture during daylight hours, unless night paving has been approved for the project.

No traffic will be permitted on material placed until the material has been thoroughly compacted and has been permitted to cool to below 38°C (100°F). The use of water to cool the pavement will not be permitted. The Engineer reserves the right to require that all work adjacent to the pavement, such as guardrail, cleanup, and turf establishment, is completed prior to placing the Hot Mix Asphalt Porous Paving course when this work could cause damage to the pavement. On projects where traffic is to be maintained, the Contractor shall schedule daily paving operations so that at the end of each working day all travel lanes of the roadway on which work is being performed are paved to the same limits. Suitable aprons to transition approaches where required shall be placed at side road intersections and driveways as directed by the Engineer.

- L. Compaction. Immediately after the hot mix asphalt mixture has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling.
1. The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving.
 2. The number, mass (weight), and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. Generally, one breakdown roller will be needed for each paver used in the spreading operation.
 3. To prevent adhesion of the mixture to the rolls, rolls shall be kept moist with water or water mixed with very small quantities of detergent or other approved material. Excess liquid will not be permitted.
 4. Along forms, curbs, headers, walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot or lightly oiled hand tampers, smoothing irons or with mechanical tampers. On depressed areas, either a trench roller or cleated compression strips may be used under the roller to transmit compression to the depressed area.
 5. Other combinations of rollers and/or methods of compacting may be used if approved in writing by the Engineer, provided the compaction requirements are met.
 6. Unless otherwise specified, the longitudinal joints shall be rolled first. Next, the Contractor shall begin rolling at the low side of the pavement and shall proceed towards the center or high side with lapped rollings parallel to the centerline. The speed of the roller shall be slow and uniform to avoid displacement of the mixture, and the roller should be kept in as continuous operation as practical. Rolling shall continue until all roller marks and ridges have been eliminated.
 7. Rollers will not be stopped or parked on the freshly placed mat.
 8. The density of compacted pavement shall be at least 92 percent, but not more than 96 percent of the corresponding daily average maximum specific gravity for each type (i.e., I, II, III, or IV) of hot mix asphalt mix placed during each day.
 9. Values above 98 percent and below 90 percent will be evaluated by the Engineer to determine whether the pavement shall be removed and replaced by the Contractor at no expense to the owner or if a greater penalty will be imposed.
 10. It shall be the responsibility of the Contractor to conduct whatever process control the Contractor deems necessary. Acceptance testing may be conducted by the owner-authorized personnel using cores provided by the Contractor.

11. Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture. The mixture shall be compacted to conform to the surrounding area. Any area showing an excess or deficiency of bitumen shall be removed and replaced. These replacements shall be at the Contractor's expense.
12. Should the Contractor choose to use vibratory rollers, the following additional criteria shall govern their operation. Vibratory rollers may be used when operated at an amplitude, frequency, and speed that produces a mat conforming to specifications and that prevents the creation of transverse ridges in the mat. A vibratory roller may be used as a breakdown roller, an intermediate roller, or a finish roller. A vibratory roller shall not be used as a substitute for a pneumatic-tired roller on leveling courses or to compact lifts of pavement less than 25 mm (1 inch) in depth. The same single vibratory roller shall not be used alone as the breakdown, intermediate, and finish roller, but may be used as any one of the rollers in the roller train.
13. If the Engineer determines that unsatisfactory compaction or surface distortion is being obtained or damage to paving components and/or adjacent property is occurring using vibratory compaction equipment, the Contractor shall immediately cease using this equipment and proceed with the work in accordance with the fourth paragraph of this Subsection.
14. The Contractor assumes full responsibility for the cost of repairing all damages that may occur to roadway or parking lot components and adjacent property if vibratory compaction equipment is used. After final rolling, no vehicular traffic of any kind shall be permitted on the surface until cooling and hardening has taken place, and in no case within the first 48 hours. Provide barriers as necessary at no extra cost to the Owner to prevent vehicular use; remove at the discretion of the Engineer.

M. Joints:

1. Joints between old and new pavements or between successive days work shall be made to ensure a thorough and continuous bond between the old and new mixtures. Whenever the spreading process is interrupted long enough for the mixture to attain its initial stability, the paver shall be removed from the mat and a joint constructed.
2. Butt joints shall be formed by cutting the pavement in a vertical plane at right angles to the centerline, at locations approved by the Engineer. The Engineer will determine locations by using a straightedge at least 4.9 m (16 feet) long. The butt joint shall be thoroughly coated with Type RS-1 emulsified asphalt just prior to depositing the paving mixture when paving resumes.
3. Tapered joints shall be formed by tapering the last 450 to 600 mm (18 to 24 inches) of the course being laid to match the lower surface. Care shall be taken in raking out and discarding the coarser aggregate at the low end of the taper, and in rolling the taper. The taper area shall be thoroughly coated with Type

RS-1 emulsified asphalt just prior to resuming paving. As the paver places new mixture on the taper area, an evenly graduated deposit of mixture shall complement the previously made taper. Shovels may be used to add additional mixture if necessary. The joint shall be smoothed with a rake, coarse material discarded, and properly rolled.

4. Longitudinal joints that have become cold shall be coated with Type RS-1 emulsified asphalt before the adjacent mat is placed. If directed by the Engineer, joints shall be cut back to a clean vertical edge prior to applying the emulsion.
- N. Surface Tolerances. The surface will be tested by the Engineer using a straightedge at least 4.9 m (16 feet) in length at selected locations parallel with the centerline. Any variations exceeding 3 mm (1/8 inch) between any two contact points shall be satisfactorily eliminated. A straightedge at least 3 m (10 feet) in length may be used on a vertical curve. The straightedges shall be provided by the Contractor.
- O. Work shall be done expertly throughout, without staining or injury to other work. Transition to adjacent impervious hot mix asphalt paving shall be merged neatly with flush, clean line. Finished paving shall be even, without pockets, and graded to elevations shown on drawing.
- P. Porous pavement beds shall not be used for equipment or materials storage during construction, and under no circumstances shall vehicles be allowed to deposit soil on paved porous surfaces.
- Q. Repair of Damaged Paving. Any existing paving on or adjacent to the site has been damaged as a result of construction work shall be repaired to the satisfaction of the Owner without additional cost to the Owner.

3.4 FIELD QUALITY CONTROL

- A. The full permeability of the pavement surface 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. Water used for the test shall be clean, free of suspended solids and deleterious liquids and will be provided at no extra cost to the Owner. All applied water shall infiltrate directly without puddle formation or surface runoff, and shall be observed by the Engineer and Owner.
- B. Testing and Inspection. Employ at Contractor's expense an inspection firm acceptable to the Engineer and Owner to perform soil inspection services, staking and layout control, and testing and inspection of site grading and pavement work. Inspection and list of tests shall be reviewed and approved in writing by the Engineer prior to starting construction. All test reports must be signed by a licensed Engineer.
- C. 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 Owner.

- D. 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.

3.5 GRADE CONTROL

- A. Establish and maintain required lines and elevations. The Engineer shall be notified for review and approval of final stake lines for the work before construction work is to begin. Finished surfaces shall be true to grade and even, free of roller marks and free of low spots to form puddles. All areas must drain.
- B. If, in the opinion of the Owner, based upon reports of the testing service and inspection, the quality of the work is below the standards which have been specified, additional work and testing will be required until satisfactory results are obtained.

3.6 POST-CONSTRUCTION MAINTENANCE

- A. During the guarantee period, the hot mix asphalt porous paving should be inspected for cracks, water ponding (failure to infiltrate), or other failures.
- B. Quarterly (every three months). Pavement surface should be vacuumed to remove sediment and organic debris. The sweeper may be fitted with water jets.
- C. As needed. Ensure that all upgradient landscaping areas are well maintained to prevent soil from being transported onto the pavement. In early Spring remove any sediment buildup at curbs and driveway aprons. Fill potholes and cracks with traditional patching mixes unless more than 10 percent of the area needs repair. If large areas (10 percent or more of the total porous paving area) need repair, consult the porous paving installer. Spot-clogging can be alleviated by drilling half-inch diameter holes through the porous paving layer every few feet.
- D. Do not store materials such as sand/salt, mulch, soil, yard waste, and other stock piles on porous surfaces.

PART 4 - COMPENSATION

Item 2510.1 --- Hot Mix Asphalt Porous Paving

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the square yard of hot mix asphalt porous paving installed by the Contractor as shown on the Contract Drawings and as directed by the Engineer, complete and as measured by the Engineer. Hot mix asphalt porous paving shall have a standard section as shown on the Contract Drawings.

BASIS OF PAYMENT:

Payment for Hot Mix Asphalt Porous Paving 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 Hot Mix Asphalt Porous Paving as shown on the Contract Drawings or at the direction of the Engineer. The work includes, but is not limited to the following; furnishing and installing hot mix asphalt porous paving course; compacting subgrade; install, grade, and compact pavement base course, filter medium, reservoir course, and choker course; compaction and compaction testing; furnishing and installing filter fabric as required; independent laboratory testing of hot mix asphalt porous paving mix; maintenance of the porous paving system for one full (1) year following construction; and all incidental work not included for payment elsewhere required to furnish and install hot mix asphalt porous paving whether included here or not.

EXCLUSIONS AND SPECIAL NOTES:

Subdrain pipe, subdrain pipe installation, excavation and disposal of material and temporary sediment controls are not included in this bid item.

Item 2510.2 --- Porous Paving Trench Excavation

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the cubic yard of excavation for the installation of the porous paving by the Contractor as shown on the Contract Drawings and as directed by the Engineer, complete and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for Porous Paving Trench Excavation 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 excavation of the trench to install the porous paving sections as shown on the Contract Drawings or at the direction of the Engineer. The work includes, but is not limited to the following; excavation to the depths required to install the porous paving section in its entirety; and all incidental work not included for payment elsewhere required to excavate the trench for the porous paving installation whether included here or not.

END OF SECTION 02510

SECTION 02524

CURBS, WALKS AND DRIVEWAYS

2524.1	4-IN CEMENT CONCRETE SIDEWALKS	SQUARE YARD
2524.2	6-IN CEMENT CONCRETE SIDEWALKS AT DRIVEWAYS	SQUARE YARD
2524.3	6-IN CEMENT CONCRETE SIDEWALKS AT PEDESTRIAN RAMPS AND INTERSECTIONS	SQUARE YARD
2524.4	6-IN REINFORCED CONCRETE DRIVEWAY AT FIRE STATION	SQUARE YARD
2524.5	WIRE CUT BRICKS ON 4-IN HOT MIX ASPHALT	SQUARE YARD
2524.6	REMOVE AND RESET/RELOCATE GRANITE CURB (STRAIGHT AND CURVED)	LINEAR FOOT
2524.7	REMOVE AND DISCARD GRANITE CURB (STRAIGHT AND CURVED)	LINEAR FOOT
2524.8	NEW GRANITE CURB TYPE VA 4 (STRAIGHT AND CURVED)	LINEAR FOOT
2524.9	NEW GRANITE CURB TYPE VA 4 TRANSITION (STRAIGHT AND CURVED)	LINEAR FOOT
2524.10	NEW GRANITE CURB TYPE VA 3 FOR RAISED CROSSWALKS	LINEAR FOOT
2524.11	NEW BEVELED CURB (STRAIGHT & CURVED)	LINEAR FOOT
2524.12	GRANITE CURB CORNER TYPE A	EACH
2524.13	CAST-IN-PLACE DETECTABLE TILE	SQUARE FOOT
2524.14	SCORED CEMENT CONCRETE PAVEMENT ISLAND	SQUARE YARD
2524.15	REMOVABLE FALSE CURB UTILITY COVER	EACH

PART 1 – GENERAL

1.1 SUMMARY

A. This Section specifies the following: cement concrete, hot mix asphalt, driveways, and Inman Square Intersection Safety Improvement Project CURBS, WALKS AND DRIVEWAYS Issued for Bid 02524-1

pedestrian ramps; the removal and resetting of curb and edging; and the construction of new granite, granite back curb, beveled curb, and asphalt curbs, berms, and edging.

1.2 RELATED WORK

- A. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- B. Section 02500 – PAVING AND SURFACING
- C. Section 02510 – HOT MIX ASPHALT POROUS PAVING
- D. Section 02900 – LANDSCAPING
- E. Section 02950 – BACK OF SIDEWALK RESTORATION
- F. Section 02980 – SITE IMPROVEMENTS
- G. Section 03300 – CONCRETE

1.3 SUBMITTALS

- A. Shop Drawings. Submit the following in accordance with Section 01300 - SUBMITTALS:
 - 1. Manufacturer product data and specifications for all materials, including, but not limited to:
 - a. Cement Concrete for sidewalks, driveways, and pedestrian ramps including design mix
 - b. Micro-fiber for sidewalk reinforcement
 - c. Membrane Curing Compound
 - d. Penetrating Liquid Concrete Sealer
 - e. Expansion Joint
 - f. Granite Curb, Granite Curb Inlet, Granite Curb Corner, Granite Edging, and Beveled Curb
 - g. Cement Concrete Design Mix for granite curb work
 - h. Hot mix asphalt for driveways, including design mix – Refer to Section 02500 – PAVING AND SURFACING for requirements
 - i. Gravel Subbase – Submit in accordance with Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADINGk. Detectable tiles
 - 2. Detail drawings and layout plans for all materials.
- B. Submit compaction testing results.

1.4 QUALITY CONTROL

- A. Cement concrete and hot mix asphalt placement, weather, and temperature restrictions shall be in accordance with Section 03300 – CONCRETE and Section 02500 – PAVING AND SURFACING.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS AND EQUIPMENT.
- B. Cement Concrete delivery time and storage time onsite shall be in accordance with Section 03300 – CONCRETE.
- C. Batch ticket information shall be submitted to the Engineer upon placement of cement concrete and hot mix asphalt.

1.6 REGULATIONS

- A. All pedestrian ramps and sidewalks shall conform to the most current applicable details of the MassDOT Highway Division; to the latest MA AAB rules and regulations; and to the latest ADA standards for accessible design.

1.7 GUARANTEES

- A. The Contractor shall guarantee all work for one year from the date of Substantial Completion from damage due to improper installation and improper use.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Cement Concrete for Sidewalks, Driveways and Pedestrian Ramps: Cement concrete shall conform to the Standard Specifications, M4.02.00 through M4.02.12 and be 4000 PSI at 28 day test, ¾-inch coarse aggregate, 610 pounds cement per cubic yard, 7% air entrained (AASHTO - M154), Type A water reducing admixture (AASHTO - M194), 3 to 4-inch slump, and Type II dark-colored by adding 1 – 1.5 lbs. of lamp black per cubic yard at the plant, dependent on the concrete supplier. Contractor shall coordinate with City of Cambridge prior to specifying lamp black additive. Cement concrete shall contain micro-fiber added during batching at the plant to insure uniform distribution.
- B. Micro-fiber: The cement concrete shall contain 1 pound of polypropylene micro-fiber per cubic yard. Fibers shall be 1/2” or 3/4” 100% polypropylene fibers, maximum 3 denier, complying with ASTM C 1116, Type III, Par. 4.1.3. Fibers per pound shall be not less than 50 million individual fibers. The micro-fiber shall be used in accordance with the manufacturer’s specifications.
- C. Curing Compound: Shall conform to Section 03300 – CAST-IN-PLACE CONCRETE for evaporation retarder.

- D. Penetrating Liquid Concrete Sealer: Shall conform to Section 03300 – CAST-IN-PLACE CONCRETE.
- E. Expansion Joints: Shall be 3/8” thick polyethylene foam and ¼” thick polyethylene foam conforming to ASTM D1751.
- F. Hot Mix Asphalt for driveways: Shall conform to the applicable subsections of Section 02500 – PAVING AND SURFACING.
- G. Granite curb, granite back curb, granite curb inlets, granite curb corners, granite edging, granite curb transitions at pedestrian ramps, beveled curb, and beveled curb transitions: Shall conform to the Standard Specifications Section M9.04.
- H. Cement Grout: Shall conform to Section 03315 – GROUT.
- I. Cement Concrete for Granite Curb, Granite Back Curb, Granite Curb Inlet, Granite Curb Corner, Granite Transitions for Pedestrian Ramps, Granite Edging, Beveled Curb and Beveled Curb Transitions: Shall conform to Class A Concrete as indicated in Section 03300 – CONCRETE.
- J. Water: Potable.
- K. Gravel Subbase: Shall be in accordance with Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
- L. Forms: Shall be in accordance with Standard Specification Section 701.61A.
- M. 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 equivalent approved by the Engineer. Size shall be 4" W by 8" L by 2 1/4" D. Brick shall meet or exceed the requirements of ASTM C902, Class SX, Abrasion 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 (55Mpa) or more. Brick shall pass a minimum of 100 freeze thaw cycles.
- N. Setting Bed: Shall contain coarse sand and aggregates mixed with the Portland Cement as processed by Rowe Contracting Company, Malden, Massachusetts or Quinn Perkins Company, Burlington, Massachusetts or approved equivalent, in order to add stability to the brick walk so that bricks will not roll, move, or rock. The sand for joint sweeping shall be mixed with Portland Cement Type II (2 parts sand to 1 part Portland Cement) and be free of coarse aggregates, enabling the fines to freely fill in around all sides of the bricks.
- O. Edge Restraints: Edge sections shall be L-shaped galvanized steel paver restraints and are to be notched to provide for smooth curves and crisp angles. Sections shall conform to the following specifications: Height: 1.5”, Flange:1.75”, Lengths:6’0” or 8’0” and Thickness: 3/16”. Edge Restraints 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 equivalent.

- P. The mastic adhesive shall consist of 2% neoprene (grade WM1) oxidized asphalt with 155 degrees F softening point (80 penetration) and 10% asbestos-free fibers and 88% asphalt. Contractor shall follow manufacturer's installation procedure.
- Q. Iron Edge Sections shall be provided at all tree pits, all locations where the back of sidewalk does not abut a hard edge and as directed by the Engineer. Iron Edge sections shall be L-shaped galvanized steel paver restraints and are to be notched to provide for smooth curves and crisp angles. Sections shall conform to the following specifications: Height: 1.5", Flange:1.75", Lengths:6'0" or 8'0" and Thickness: 16 gauge. 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.
- R. Spikes: Are to be galvanized steel spiral not less than 10" in length.
- S. Detectable tiles: 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. The detectable warning strip at brick interfaces shall be yellow dipped.

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.

PART 3 – EXECUTION

3.1 PREPARATION

- A. The edges of existing pavement, which is to remain, shall be saw cut to an even, straight edge in accordance with Section 01045 – CUTTING, CORING AND PATCHING. This includes roadways, sidewalks, and driveways.
- B. Excavate, remove, segregate, and stockpile existing asphalt and cement concrete walks and driveways as required for utility installation or as indicated for replacement on the Contract Drawings.
 - 1. Existing walks and driveways shall be sawcut at the limits of removal. Cement concrete walks and driveways shall be sawcut at existing score joint, so entire panel is removed.
 - 2. Prior to excavation for pedestrian ramps, the Contractor shall review the location with the Engineer to determine what is necessary to allow for the installation to be compliant with the standards referenced above. Fixed objects such as utility poles and fire hydrants must be considered in location of

- pedestrian ramps. The type of pedestrian ramp may vary based on sidewalk width and slope.
3. Removed cement concrete and asphalt pavement including reinforcement shall be disposed of in accordance with Section 02051 – DEMOLITION, MODIFICATION, ABANDONMENT.
 4. Excess soil material removed shall be disposed of in accordance with Section 02080 – SOIL AND WASTE MANAGEMENT.
- C. Excavate, remove, protect, and stack existing granite curb, granite edging, granite curb corners, and granite curb inlets as required for utility installations or as indicated for replacement on the Contract Drawings in accordance with the Standard Specifications Section 580.
 - D. Existing granite curb, granite edging, granite curb corners, and granite curb inlets not indicated to be reset shall be disposed of in accordance with Section 02051 – DEMOLITION, MODIFICATION, ABANDONMENT
 - E. The Contractor shall exercise special care when excavating near trees and roots. Excavation shall conform to the requirements in Section 02100 – SITE PREPARATION AND TREE PRUNING.
 - F. Traffic signs shall be removed as required during the excavation. Bike rings, trash receptacles, parking meters and signs, etc. to be reused shall be appropriately protected, stacked, and stored for reuse. Traffic signs to be replaced, as indicated on the Contract Drawings or as required by the Engineer, shall be disposed of by the Contractor. Reinstallation of traffic signs shall be done the prior to the concrete pour. All regulatory signs shall be maintained throughout construction.
 - G. Subgrade under walks, pedestrian ramps, driveways, and curbs shall be graded to required elevations and proof rolled.
 - H. **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 sidewalk areas are graded to drain, either to existing structures or new structures.**
 - I. Gravel subbase under sidewalks, pedestrian ramps, driveways, and curbs shall be graded to required elevations and compacted with plate-type mechanical compactors 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.
 - J. Existing in-situ material shall be used for gravel subbase only when approved by the Engineer. The Contractor shall provide analytical proctor results of the existing material in accordance with Section 02210 - EARTH EXCAVATION, BACKFILL, FILL, AND GRADING for compaction testing if requested by the Engineer.

- K. Imported gravel subbase shall be placed in one six-inch lift, loose measure unless otherwise noted.
- L. Add approved material to bring to required grade and compact.
- M. The subbase for sidewalks shall be graded to be sloped from the City right of way towards the street in order to meet ADA requirements, or as shown on the Contract Drawings, or as required by the Engineer.
- N. Materials shall not be placed when subgrade and subbase is muddy, frozen, or has frost, snow, or water thereon.
- O. The Contractor shall raise all water curb stop boxes and sewer, drain, and combined sewer castings to final grade and shall coordinate raising of other utility boxes and castings 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 review locations where curb boxes have been raised with the Engineer.

3.2 CEMENT CONCRETE WALKS AND DRIVEWAYS

- A. Concrete shall be installed to a depth of 6" at pedestrian ramps, 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. Concrete shall be reinforced and installed to a depth of 6" across the fire station driveway. At all other locations, concrete shall be installed to a depth of 4".
- B. Concrete shall be placed between April 1st (pending no upcoming snow storms) and November 1st only. Do not place concrete when air temperature at time of placement, or anticipated temperature for following 24 hours, is lower than 40° F or higher than 90° F.
- C. Forms shall be placed in accordance with Standard Specification Section 701.61A.
- D. Concrete placement shall be in accordance with the Standard Specifications Section 701.61B.
 - 1. The concrete shall be placed in alternating slabs 30 feet in length unless otherwise required by the Engineer.
 - 2. The slabs shall be separated by transverse performed expansion joint filler as specified below:
 - a. Expansion joints of 3/8" thick foam shall be placed every 30 feet perpendicular to curb alignment extending through the sidewalk depth. Expansion joints of 3/8" thick foam shall also be placed around all appurtenances such as utility poles, hydrants, manholes, and other obstructions extending into and to a depth to match the adjacent sidewalk (4", 6"). Six-inch expansion joints shall be placed at all

pushbroom with a long handle over the surface of the concrete to produce a non-slip surface.

- F. Concrete shall be membrane-cured. The curing compound shall not discolor the concrete, shall be compatible with linseed oil application after 28 days, 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.
- G. Penetrating Liquid Concrete Sealer: Prepare, apply, and finish penetrating liquid concrete sealer according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than 14 days old.
- H. Forms shall be left in place for a period of 12-hours prior to removal. Upon removal, the Contractor shall backfill the void with either loam in accordance with Section 02210 – EARTH EXCAVATION, FILL, BACKFILL AND GRADING and seeded in accordance with Section 02900 – LANDSCAPING or match the existing material and grade as specified.
- I. After 28 days, 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% 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). The sidewalk shall be swept and cleaned of any debris, gum, etc. and pressure washed, just prior to application of curing linseed oil compound.
- J. The Contractor shall fully protect all new concrete work for a minimum of forty-eight hours. A representative of the Contractor shall remain on site at least three hours after the last section of concrete is placed. In addition, the contractor shall fully protect the concrete with plastic sheeting or matting. Plastic sheeting shall be installed so that it cannot pull or blow away under windy conditions and not damage installed concrete. Sidewalk vandalized or disturbed within three hours after the last section of concrete is placed shall be replaced by the Contractor at no additional cost to the Owner.

3.3 CEMENT CONCRETE PEDESTRIAN RAMPS

- A. Concrete shall be installed to a depth of 6" depth.
- B. The Contractor shall establish grade elevations at all pedestrian ramp locations, and shall set transition lengths as shown on the Contract Drawings and as per ADA and MA AAB requirements.

- C. All pedestrian ramp 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).
- D. At intersections, pedestrian ramps shall be located in front of vehicle stop lines and within the crosswalk. The ramp shall be constructed so that the finished elevation of the concrete (curb removed) will meet the roadway flush (less than ½” lip) for a width no less than 42 inches. The elevation at this meeting point shall be properly designed to meet the gutter elevation of the road. The Contractor shall install pedestrian ramps and road grades in a manner which minimizes the potential for puddles in front of them.
- E. The Contractor shall use a digital “Smart Level” to check all subbase grades for compliance prior to installation of concrete. The Contractor shall not proceed with concrete installation on a ramp that is out of compliance without first contacting the Engineer.
- F. Forming, placement, finishing, curing and alkaline resistant protective penetrating concrete sealer shall be completed in accordance with Paragraph 3.2 of this Section except the pushbroom finish, which shall be perpendicular to the direction of the slope.

3.4 DETECABLE TILE

- A. Set detectable tile plate(s) into wet concrete in accordance with ADA and MA AAB requirements.
- B. Tamp plate(s) thoroughly with rubber mallet until concrete seeps through vent holes.
- C. Clean off excess concrete from plate(s) and finish concrete around plate(s).
- D. Cast iron detectable tiles shall be installed at time of sidewalk construction per manufacturer’s directions and as shown on the plans and specified herein. Retrofit, bolter or surface applied installations shall not be accepted.

3.5 BRICK WALKS AND DRIVEWAYS

- A. Hot mix asphalt base shall be installed to a depth of 4” and placed in accordance with the MHD Standard Specifications for hot mix asphalt.
 - 1. Hot mix asphalt surface shall be rolled to remove irregularities prior to installing stone dust.
- B. The iron edge shall be installed as detailed, longitudinally to the granite curb at the back edge of the specified brick walk width and at all tree wells. The iron edge shall be secured by 10” spiral galvanized steel spikes placed every 12”.
- C. A 3/4” sand setting bed shall be installed on the asphalt base. Wet saw is required for cutting of bricks and filling in pieces where needed. No other method will be

acceptable.

- D. After all the bricks are in place, stone dust free of coarse aggregates shall be swept into the voids around the bricks.
- E. 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.
- F. Contractor shall follow manufacturer's installation procedures for the installation of mastic adhesive.

3.5 GRANITE CURB, GRANITE BACK CURB, GRANITE CURB CORNER, GRANITE CURB INLET GRANITE CURB TRANSITION AT PEDESTRIAN RAMPS, GRANITE EDGING, BEVELED CURB, AND BEVELED CURB TRANSITION.

- A. Granite Curb, Granite Back Curb, Granite Curb Corners, Granite Curb Inlets, Granite Curb Transitions at Pedestrian Ramps, Granite Edging, Beveled Curb, and Beveled Curb Transitions shall be installed in accordance with the requirements of Section 501 of the Standard Specifications.
- B. Existing Granite Curb, Granite Curb Corners, Granite Curb Inlets, Granite Curb Transitions at Pedestrian Ramps, and Granite Edging that are to be removed and reset shall be installed in accordance with the requirements of Section 580 of the Standard Specifications.
 - 1. The Contractor shall verify and record all existing grades at locations where granite will be reset at the existing grade.
- C. Installations shall be backfilled with concrete as indicated on the Contract Drawings.

3.6 ASPHALT CURBS, BERMS, WALKS, DRIVEWAYS AND WATERWAYS

- A. Hot mix asphalt driveways shall be placed in accordance with the Standard Specifications Section 701.63.

PART 4 – COMPENSATION

Item 2524.1 – 4-Inch Cement Concrete Sidewalks

METHOD OF MEASUREMENT:

Measurement for 4-inch Cement Concrete Sidewalks shall be based on the square yard installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for 4-inch Cement Concrete Sidewalks shall be based on the square yard of 4-in Cement Concrete Sidewalks installed complete for this item in the proposal. Under the square yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required

for the installation of 4-in Cement Concrete Sidewalks as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; remove, transport, stack, protect, and reset all parking meters, signs, or other items obstructing the construction of the sidewalk; excavate, removal and disposal of existing sidewalks; install, grade, compact, and test compaction of gravel sub-base and sub-grade; raise and adjust gate boxes, frames and covers, and other castings; furnish, install and compact Gravel Sub-base; furnish and install Cement Concrete complete with micro-fiber, expansion joints, and formwork; finish the Concrete; furnish and place the curing compound; protect the concrete after placement; furnish and place penetrating liquid concrete sealer; remove and dispose of formwork; backfilling; furnish and install loam and seed, mulch, or other backing and/or adjacent material specified including tree pits and grass areas; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; sidewalks installed to replace sidewalks damaged by the Contractor during construction; and 6-in sidewalks at driveways and pedestrian ramps.

Item 2524.2 – 6-Inch Cement Concrete Sidewalks at Driveways

METHOD OF MEASUREMENT:

Measurement for 6-inch Cement Concrete Sidewalks at Driveways shall be based on the square yard installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for 6-inch Cement Concrete Sidewalks at Driveways shall be based on the square yard of 6-inch Cement Concrete Sidewalks at Driveways installed complete for this item in the proposal. Under the square yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of 6-inch Cement Concrete Sidewalks at Driveways as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; remove, transport, stack, protect, and reset all parking meters, signs or other items obstructing the construction of the sidewalk and driveway; excavate, removal and disposal of existing sidewalks and driveways; furnish, install, grade, compact and test compaction of gravel sub-base and sub-grade; raise and adjust gate boxes, frames and covers and other castings; furnish and install Cement Concrete complete with micro-fiber, expansion joints, and formwork; finish the Concrete; furnish and place the curing compound; protect the concrete after placement; furnish and place penetrating liquid concrete sealer; remove and dispose of formwork; reinforcing; backfilling; furnish and install loam and seed, mulch, or other backing and/or adjacent material specified including tree pits and grass areas; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; sidewalks installed to replace sidewalks damaged by the Contractor during construction; 4-in sidewalks; pedestrian ramps; and the driveway in front of the Inman Fire Station.

Item 2524.3 – 6-Inch Cement Concrete at Pedestrian Ramps and Intersections

METHOD OF MEASUREMENT:

Measurement for 6-inch Cement Concrete at Pedestrian Ramps and Intersections shall be based on the Inman Square Intersection
Safety Improvement Project

square yard installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for 6-inch Cement Concrete at Pedestrian Ramps and Intersections shall be based on the square yard of 6-inch Cement Concrete at Pedestrian Ramps and Intersections installed complete for this item in the proposal. Under the square yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of 6-in Cement Concrete Pedestrian Ramps as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; remove, transport, stack, protect, and reset all parking meters, signs or other items obstructing the construction of the sidewalk; excavate, removal and disposal of pedestrian ramps; furnish, install, grade, compact and test compaction of gravel sub-base and sub-grade; raise and adjust gate boxes, frames and covers and other castings; furnish and install Cement Concrete complete with micro-fiber, expansion joints, and formwork; finish the Concrete; furnish and place the curing compound; protect the concrete after placement; furnish and place penetrating liquid concrete sealer; remove and dispose of formwork; reinforcing; backfilling; furnish and install loam and seed, mulch, or other backing and/or adjacent material specified including tree pits and grass areas; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; sidewalks installed to replace sidewalks damaged by the Contractor during construction; 4-in sidewalks; and 6-in sidewalks at driveways.

Item 2524.4 – 6-Inch Reinforced Concrete Driveway at Fire Station

METHOD OF MEASUREMENT:

Measurement for 6-inch Reinforced Concrete Driveway at Fire Station shall be based on the square yard installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for 6-inch Reinforced Concrete Driveway at Fire Station shall be based on the square yard of 6-inch Reinforced Concrete Driveway at Fire Station installed complete for this item in the proposal. Under the square yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of 6-in Reinforced Concrete Driveway at Fire Station as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; remove, transport, stack, protect, and reset all parking meters, signs or other items obstructing the construction of the sidewalk; excavate, removal and disposal of sidewalk; furnish, install, grade, compact and test compaction of gravel sub-base and sub-grade; raise and adjust gate boxes, frames and covers and other castings; furnish and install Cement Concrete complete with reinforcement, expansion joints, and formwork; finish the Concrete; furnish and place the curing compound; protect the concrete after placement; furnish and place penetrating liquid concrete sealer; remove and dispose of formwork; reinforcing; backfilling; furnish and install loam and seed, mulch, or other backing and/or adjacent material specified including tree pits and grass areas; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; sidewalks installed to replace Inman Square Intersection
Safety Improvement Project
Issued for Bid

sidewalks damaged by the Contractor during construction; 4-in sidewalks; and 6-in sidewalks at driveways and pedestrian ramps excluding the Fire Station driveway.

Item 2524.5 - Wire Cut Bricks on 4-In Hot Mix Asphalt

METHOD OF MEASUREMENT:

Measurement for Wire Cut Bricks on 4-inch Hot Mix Asphalt shall be based on the square yard installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Wire Cut Bricks on 4-inch Hot Mix Asphalt shall be based on the square yard of Wire Cut Bricks on 4-in Hot Mix Asphalt installed complete for this item in the proposal. Under the square yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Wire Cut Bricks on 4-in Hot Mix Asphalt as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; remove, transport, stack, protect, and reset all parking meters, signs or other items obstructing the construction of the sidewalk; furnish, install, grade, compact, and test compaction of gravel sub-base and sub-grade; raise and adjust gate boxes, frames and covers, and other castings; removal and disposing existing bricks; furnish and install hot mix asphalt base; compaction of the hot mix asphalt base; protect the asphalt after placement; furnish and install wire cut bricks; furnish and install iron edge with spiral galvanized steel spikes; furnish and install ¾" sand dust setting bed; applying asphalt tack coat and neoprene modified asphalt tack coat; sweeping with dry sand/ cement mix; compaction of bricks; backfilling; furnish and install loam and seed, mulch, or othr backing and/or adjacent material specified including tree pits and grass areas; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; brick installed to replace bricks damaged by the Contractor during construction.

Item 2524.6 --- Remove and Reset/Relocate Granite Curb (Straight and Curved)

METHOD OF MEASUREMENT:

Measurement for Remove and Reset/Relocate Granite Curb (Straight and Curved) shall be based on the linear foot of granite curb removed and reset installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer. Payment will be made only after the curb has been reset.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Remove and Reset/Relocate Granite Curb (Straight and Curved) shall be based on the linear foot of granite curb removed and reset or relocate complete for this item in the proposal. Under the linear foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to remove and reset and/or relocate existing granite curb as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; saw cut; excavate, remove, transport, stack, protect and reset straight and curved granite curb; furnish, install, grade, compact and test compaction of gravel sub-base and sub-grade; modifications to the existing granite curb; furnish and install Cement Concrete; point the granite curb; backfilling; furnish and install loam and seed, mulch, or other backing material specified; and all other work not included for payment

elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; granite curb removed and reset to accommodate the Contractor's means and methods; new curb to replace curb damaged by the Contractor; new granite curb; and removing and resetting granite curb transition for pedestrian ramps.

Item 2524.7 --- Remove and Discard Granite Curb (Straight and Curved)

METHOD OF MEASUREMENT:

Measurement for Remove and Discard Granite Curb (Straight and Curved) shall be based on the linear foot of granite curb removed and relocated installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer. Payment will be made only after the curb has been relocated.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Remove and Discard Granite Curb (Straight and Curved) shall be based on the linear foot of Granite Curb removed from an existing alignment and discarded. Under the per linear foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to remove and dispose of existing granite curb as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; saw cut; excavate, remove and transport, existing damaged or unsalvageable straight and curved granite; backfilling; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; granite curb removed and discarded to accommodate the Contractor's means and methods; and disposal of existing granite curbing.

Item 2524.8 --- New Granite Curb Type VA4 (Straight and Curved)

METHOD OF MEASUREMENT:

Measurement for New Granite Curb Type VA4 (Straight and Curved) shall be based on the linear foot of granite curb installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for New Granite Curb Type VA4 (Straight and Curved) shall be based on the linear foot of Granite Curb (straight and curved) installed complete for this item in the proposal. Under the per linear foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install new granite curb as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; saw cutting; excavation; furnish, install, grade, compact and test compaction of gravel sub-base and sub-grade; furnish and install new granite curb (straight and curved); install curbing at shallow depths as required; furnish and install cement concrete; point the granite curb; backfilling; furnish and install loam and seed, mulch, or other backing material specified; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; granite curb removed and reset to accommodate the Contractor's means and methods; new curb to replace curb damaged by the

Contractor; new granite transition curb at pedestrian ramps, driveways, and curb corners; and removing and resetting granite curb.

Item 2524.9 --- New Granite Curb Type VA4 Transition (Straight and Curved)

METHOD OF MEASUREMENT:

Measurement for New Granite Curb Type VA4 Transition (Straight and Curved) shall be based on the linear foot of granite transition curb installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for New Granite Curb Type VA4 Transition Curb (Straight and Curved) shall be based on the linear foot of Granite Transition Curb (straight and curved) installed complete for this item in the proposal. Under the per linear foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install new granite transition curb at pedestrian ramps as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; remove existing damaged and unsalvageable curb; saw cutting; excavation; furnish, install, grade, compact, and test compaction of gravel sub-base and sub-grade; furnish and install new granite transition curb at pedestrian ramps (straight and curved); furnish and install cement concrete; point the granite curb; backfilling; furnish and install loam and seed, mulch, or other backing material specified; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; granite curb removed and reset to accommodate the Contractor's means and methods; new curb to replace curb damaged by the Contractor; new granite transition curb corners and curb corners; furnishing imported gravel sub-base; and removing and resetting granite curb.

Item 2524.10 --- New Granite Curb Type VA3 for Raised Crosswalks

METHOD OF MEASUREMENT:

Measurement for New Granite Back Curb Type VA3 for Back of Sidewalks and Raised Crosswalks shall be based on the linear foot of granite curb installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for New Granite Back Curb Type VA3 for Back of Sidewalks and Raised Crosswalks shall be based on the linear foot of Granite Curb installed complete for this item in the proposal. Under the per linear foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install new granite back curb as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; saw cutting; excavation; furnish, install, grade, compact and test compaction of gravel sub-base and sub-grade; furnish and install new granite back curb (straight); furnish and install cement concrete; point the granite back curb; backfilling; furnish and install loam and seed, mulch, or other backing material specified; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; granite curb removed and reset to accommodate the Contractor's means and methods; new curb to replace curb damaged by the

Contractor; new granite transition curb at pedestrian ramps, driveways, and curb corners; and removing and resetting granite curb. This item includes the raised curbing located between and the curbing.

Item 2524.11 --- New Beveled Curb (Straight & Curved)

METHOD OF MEASUREMENT:

Measurement for New Beveled Curb (Straight and Curved) shall be based on the linear foot of beveled curb and beveled transition curb installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for New Beveled Curb (Straight and Curved) shall be based on the linear foot of beveled curb and beveled transition curb installed complete for this item in the proposal. Under the per linear foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install new beveled curb and beveled curb transition as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; remove existing damaged and unsalvageable curb; saw cutting; excavation; furnish, install, grade, compact, and test compaction of gravel sub-base and sub-grade; furnish and install new granite transition curb at pedestrian ramps (straight and curved); furnish and install cement concrete; point the granite curb; backfilling; furnish and install loam and seed, mulch, or other backing material specified; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; granite curb removed and discarded to accommodate the Contractor's means and methods; new curb to replace curb damaged by the Contractor; and furnishing imported gravel sub-base.

Item 2524.12 --- Granite Curb Corner Type A

METHOD OF MEASUREMENT:

Measurement for Granite Curb Corner Type A shall be based on Each of granite curb corners installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Granite Curb Corner Type A shall be based on Each Granite Curb Corner installed complete for this item in the proposal. Under the Each price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install new granite curb corners as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; saw cutting; excavation; furnish, install, grade, compact and test compaction of gravel sub-base and sub-grade; furnish and install new granite curb corner; furnish and install cement concrete; point the granite curb corner; backfilling; furnish and install loam and seed, mulch, or other backing material specified; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; granite curb removed and reset to accommodate the Contractor's means and methods; new Type VA 4 granite curb; and removing and resetting granite curb.

Item 2524.13--- Cast-in-Place Detectable Tile

METHOD OF MEASUREMENT:

Measurement for Cast-in-place Detectable Tile shall be based on square footage of detectable tile installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Cast-in-place Detectable Tile shall be based on square feet of Cast-in-place Detectable Tile installed complete for this item in the proposal. Under the Each price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install detectable tiles as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; furnish install cast iron detectible warning panels; and all other work not included for payment elsewhere.

Item 2524.14 – Scored Cement Concrete Pavement Island

METHOD OF MEASUREMENT:

Measurement for Scored Cement Concrete Pavement Island shall be based on the square yard installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Scored Cement Concrete Pavement Island shall be based on the square yard of Scored Cement Concrete Pavement Island installed complete for this item in the proposal. Under the square yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Scored Cement Concrete Pavement Island as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; remove, transport, stack, protect, and reset all parking meters, signs or other items obstructing the construction of scored cement concrete pavement island; excavate, removal and disposal of sidewalk; furnish, install, grade, compact and test compaction of gravel sub-base and sub-grade; raise and adjust gate boxes, frames and covers and other castings; furnish and install Cement Concrete complete with reinforcement, micro-fiber, expansion joints, scoring, and formwork; finish the Concrete; furnish and place the curing compound; protect the concrete after placement; furnish and place penetrating liquid concrete sealer; remove and dispose of formwork; reinforcing; backfilling; furnish and install loam and seed, mulch, or other backing and/or adjacent material specified including tree pits and grass areas; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; sidewalks installed to replace sidewalks damaged by the Contractor during construction; 4-in sidewalks; and 6-in sidewalks at driveways.

Item 2524.15 --- Removeable False Curb Utility Cover

METHOD OF MEASUREMENT:

Measurement for Removeable False Curb Utility Cover shall be based on Each of Removeable False Curb Utility Cover installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Removeable False Curb Utility Cover shall be based on Each Removeable False Curb Utility Cover installed complete for this item in the proposal. Under the Each price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required to install new Removeable False Curb Utility Covers as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; saw cutting; excavation; furnish, install, grade, compact and test compaction of gravel sub-base and sub-grade; furnish and install new Removeable False Curb Utility Cover; furnish and install cement concrete; adjust the Removeable False Curb Utility Cover; backfilling; furnish and install loam and seed, mulch, or other backing material specified; and all other work not included for payment elsewhere.

SPECIAL NOTES ON EXCLUSIONS:

The following items are not included for payment under this item; granite curb removed and reset to accommodate the Contractor's means and methods; new Type VA 4 granite curb; and removing and resetting granite curb.

END OF SECTION 02524

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SECTION 02577

PAVEMENT MARKINGS

2577.1	4-IN TO 8-IN REFLECTORIZED PAVEMENT MARKINGS – YELLOW AND WHITE THERMOPLASTIC	LINEAR FOOT
2577.2	PAVEMENT ARROWS & LEGENDS REFL. WHITE (SURFACE APPLIED TAPE)	SQUARE FOOT
2577.3	PAVEMENT ARROWS & LEGENDS REFL. WHITE (THERMOPLASTIC)	SQUARE FOOT
2577.4	CROSSWALKS AND STOP LINES REFL. WHITE (THERMOPLASTIC)	SQUARE FOOT
2577.5	HIGH FRICTION SURFACE TREATMENT	SQUARE FOOT
2577.6	BIKES YIELD TO PEDS MARKING (SURFACE APPLIED TAPE)	EACH
2577.7	HIGH SRI SURFACE PAINT	SQUARE YARD

PART 1 – GENERAL

1.1 SUMMARY

- A. Furnish and apply pavement markings in accordance with the MassDOT Highway Division, Standard Specifications for Highways and Bridges, latest edition, hereinafter referred to as the "Standard Specifications." All references to method of measurement, basis of payment, and payment items in the standard specifications are hereby deleted. References made to particular sections or paragraphs in the Standard Specifications shall include all related articles mentioned therein.

1.2 RELATED WORK

- A. Section 02500 – PAVING AND SURFACING

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 – SUBMITTALS:
 - 1. Product data and specification submittals.

2. For information purposes only, submit manufacturer's printed installation instructions.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. M7.01.03 White Thermoplastic Reflectorized Pavement Markings.
- B. M7.01.04 Yellow Thermoplastic Reflectorized Pavement Markings.
- C. M7.01.07 Glass Beads
- D. High Friction Surface Treatment: Shall be “TYREGRIP VS” as manufactured by Prismo, USA, Inc.; or approved equivalent product. Color shall be green for bicycle applications and terra cotta for bus applications, and shall conform to the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD) and the following:

- a. Daytime chromaticity coordinates for the color green shall be as follows:

1		2		3		4	
x	y	x	y	x	y	x	y
0.230	0.754	0.266	0.500	0.367	0.500	0.444	0.555

Daytime chromaticity coordinates for the color terra cotta shall be as follows:

1		2		3		4	
x	y	x	y	x	y	x	y
0.023	0.754	0.266	0.500	0.367	0.500	0.444	0.555

- b. Daytime luminance factor (Y) shall be at least 7, but no more than 35 for both green and terra cotta colors.

- c. Nighttime chromaticity coordinates for the color green shall be as follows:

1		2		3		4	
x	y	x	y	x	y	x	y
0.230	0.754	0.336	0.540	0.450	0.500	0.479	0.520

Nighttime chromaticity coordinates for the color terra cotta shall be as follows:

1		2		3		4	
x	y	x	y	x	y	x	y
0.023	0.754	0.336	0.540	0.450	0.500	0.479	0.520

- E. High SRI Surface Paint shall be Streetbond SB150 as manufactured by GAF, or approved equivalent. Provide warranty of 3 years.

PART 3 – EXECUTION

3.1 GENERAL

- A. Apply Pavement Markings as follows:

Material	Material Application Temperature Degrees F	Line Thickness Inches	Reflectorized Application
M7.01.03	400-425	5.0 – 7.5	1lb/10 SF Drop On
M7.01.04	400-425	5.0 – 7.5	1lb/10 SF Drop On

- B. The ambient air temperature for thermoplastic application shall be minimum of 45 degrees F and rising at the time of marking operations. If work has started and air temperatures fall below 45 degrees F [7.2 C] and continuous cooling is indicated, work shall be stopped. In cool weather conditions, temporary drops in temperature down to 40 degrees F [4.4 C] may be tolerated, providing temperatures also vary upwards. Sustained striping (greater than one hour) at 40 degrees F [4.4 C] shall not be allowed. Starting work at air temperatures lower than 45 degrees F [7.2 C] shall not be allowed.
- C. Apply markings at cross walks and stop lines at the locations required by the Engineer or as shown in the Drawings.
- D. Align new markings to match existing in color, dimensions, and spacing, and extend new markings where required.
- E. Marking widths for crosswalks and stop lines shall be 24 inches and 12 inches respectively and applied within a tolerance of five percent. Deviation of straight strips shall not exceed ½-inch in 50 feet.
- F. Existing pavement markings no longer required shall be completely removed, by grinding method, prior to placement of any temporary lines.
- G. Pavement markings for crosswalks, fog lines, and stop lines shall be white. Pavement markings for centerlines shall be yellow.
- H. All temporary pavement markings shall be traffic paint. All permanent markings shall be thermoplastic. Pavement markings for centerlines shall be yellow.
- I. 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.

- J. Broken lines through intersections (vehicular and bicycle) are indicated only graphically on the plans. Actual pattern shall be 4-foot line and 4-foot space.
- K. Pavement arrows and legends in areas subject to general vehicle traffic shall be thermoplastic. Pavement arrows, legends and “Bikes Yield to Peds” pavement marking on bicycle facilities shall be surface applied tape.
- L. The green-colored 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 terra cotta -colored high friction surface treatment shall be installed at bus lanes 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’ 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.
- M. High SRI Surface Paint shall be installed with a minimum of 4 layers with 5 gallons per 600 square feet. Thoroughly clean the surface and mask off areas where the surface paint is not required. Install surface paint in accordance with all manufacturers’ installation and materials specifications.

PART 4 – COMPENSATION

2577.1 - 4-in to 8-in Reflectorized Pavement Markings – Yellow and White Thermoplastic

METHOD OF MEASUREMENT:

Measurement for payment for Reflectorized Pavement Markings shall be per linear foot of lines applied with thermoplastic. Broken lines shall be paid by deducting ¼ of the total linear foot of roadway painted with full deductions for breaks greater than 10-feet.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Reflectorized Pavement Markings shall be based on the linear foot price complete for this item in the proposal. Under the linear foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for installing Reflectorized Pavement Markings. The work includes, but is not limited to: sweeping, furnish, apply, and protect all thermoplastic pavement lines; grinding and removing pavement markings and lines no longer required.

EXCLUSIONS:

The following items are not included for payment under this item: Permanent crosswalks; painted lines for temporary or traffic management lines and crosswalks will not be paid for under this item but are considered incidental to other items.

2577.2 - Pavement Arrows & Legends- Refl. White (Surface Applied Tape)

METHOD OF MEASUREMENT:

Measurement for payment for reflectorized pavement markings shall be per square foot of arrows and legends applied with surface applied tape as specified.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Reflectorized Pavement Markings shall be based on the square foot price complete for this item in the proposal. Under the square foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for installing Reflectorized Pavement Markings. The work includes, but is not limited to: sweeping, furnish, apply, and protect all surface applied tape pavement markings; grinding and removing pavement markings and lines no longer required.

EXCLUSIONS:

The following items are not included for payment under this item: Painted lines for temporary or traffic management will not be paid for under this item but are considered incidental to other items.

2577.3 - Pavement Arrows & Legends Refl. White (Thermoplastic)

METHOD OF MEASUREMENT:

Measurement for payment for reflectorized pavement markings shall be per square foot of arrows and legends applied with thermoplastic as specified.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Reflectorized Pavement Markings shall be based on the square foot price complete for this item in the proposal. Under the square foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for installing Reflectorized Pavement Markings. The work includes, but is not limited to: sweeping, furnish, apply, and protect all surface applied thermoplastic pavement markings; grinding and removing pavement markings and lines no longer required.

EXCLUSIONS:

The following items are not included for payment under this item: Painted lines for temporary or traffic management will not be paid for under this item but are considered incidental to other items.

2577.4 – Crosswalks and Stop Lines Refl. White (Thermoplastic)

METHOD OF MEASUREMENT:

Measurement for payment for Crosswalks and Stop Lines Reflectorized Pavement Markings shall be per square foot of lines applied with thermoplastic.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Crosswalks and Stop Lines Reflectorized Pavement Markings shall be per square foot of lines applied with thermoplastic price complete for this item in the proposal. Under the square foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for installing Reflectorized Pavement Markings. The work includes, but is not limited to: sweeping, furnish, apply, and protect all thermoplastic pavement lines; grinding and removing pavement markings and lines no longer required.

2577.5 - High Friction Surface Treatment

METHOD OF MEASUREMENT:

Measurement for payment for high friction surface treatment shall be per square foot of surface treatment installed as specified.

BASIS OF PAYMENT / INCLUSIONS:

Payment for High Friction Surface Treatment shall be based on the square foot price complete for this item in the proposal. Under the square foot price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for installing High Friction Surface Treatment. The work includes, but is not limited to: sweeping, furnish, apply, and protect all surface applied tape or thermoplastic pavement markings; grinding and removing pavement markings and lines no longer required.

2577.6 - Bikes Yield to Peds Marking (Surface Applied Tape)

METHOD OF MEASUREMENT:

Measurement for payment for Bikes Yield to Peds Marking (Surface Applied Tape) shall be per each Bikes Yield to Peds marking installed as specified.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Bikes Yield to Peds Marking (Surface Applied Tape) shall be based on the each price complete for this item in the proposal. Under the each price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for installing Bikes Yield to Peds Marking (Surface Applied Tape). The work includes, but is not limited to: sweeping, furnish, apply, and protect all surface applied tape.

2577.7 - High SRI Surface Paint

METHOD OF MEASUREMENT:

Measurement for payment for High SRI Surface Paint shall be per square yard of pavement coating installed as specified.

BASIS OF PAYMENT / INCLUSIONS:

Payment for pavement coating shall be based on the square yard price complete for this item in the proposal. Under the square yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for installing the surface paint. The work includes, but is not limited to: sweeping, furnish, apply, and protect all surface paint; grinding and removing pavement markings and lines no longer required.

END OF SECTION 02577

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, brick inverts and tables, raising and adjusting castings, and for all other necessary appurtenant work complete and accepted in accordance with the Drawings and Specifications and as directed.

1.2 RELATED TECHNICAL SECTIONS

- A. Section 02051 – DEMOLITION, MODIFICATION, AND ABANDONMENT
- B. Section 02252 – MANHOLES
- C. Section 03410 – PLANT-PRECAST STRUCTURAL CONCRETE

1.3 SUBMITTALS

- A. 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 – PRODUCTS

2.1 MATERIALS

- A. Masonry
 - 1. Masonry shall include brick masonry for extending manhole and catch basin frames to grade, brick masonry 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 a minimum of 8-inches thick, unless otherwise shown or directed. Other brick masonry shall be provided to the details and the dimensions specified, indicated or as directed.

B. Bricks

1. 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.
2. Brick for extending manhole frames to grade shall be concrete brick conforming to ASTM C139, latest revision.

C. Cement

1. 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.

D. Sand

1. 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.

E. Lime

1. Lime shall be hydrated lime conforming to ASTM C207, latest revision.

F. Water

1. 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.

G. Mortar

1. 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 GENERAL

- A. 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.
- B. All workmanship shall conform to the best standard practice, and all brick masonry shall be laid by skilled workmen. Brick masonry for extending frames to grade shall be constructed to the thickness indicated. 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.
- C. 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

SECTION 02604

CATCH BASINS

2604.1	CATCH BASIN – TYPE 1 SINGLE GRATE (4-FT DIAMETER)	EACH
2604.2	CATCH BASIN – TYPE 5 DIRECT INLET	EACH
2604.3	CATCH BASIN – TYPE 3 SINGLE GRATE (3’x4’)	EACH
2604.4	PLAZA AREA DRAIN INLET AND RISER	EACH

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Furnishing, installing, and testing of precast concrete catch basins and area drain inlets, complete and in place, within the limits and to the lines and grades indicated.

1.2 RELATED TECHNICAL SECTION

- A. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- B. Section 02252 – MANHOLES
- C. Section 02590 – BRICK MASONRY
- D. Section 03300 – CONCRETE
- F. Section 03315 – GROUT
- E. Section 07160 – BITUMINOUS DAMPPROOFING

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01300 – SUBMITTALS:

1. Complete shop drawings for all precast catch basin sections, cast iron frames and covers, plaza area drain inlet and riser, and appurtenances.

2. Prior to fabrication, submit shop drawings showing details of precast monolithic base sections; risers; eccentric cone and flat slab catch basin tops; joints and gaskets; and construction details, tolerances, and other information as required by the Owner.
3. Submit manufacturer's recommended installation procedures for informational purposes.

1.4 QUALITY CONTROL

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. Owner reserves right to inspect and test by independent services at manufacturer's plant or elsewhere at his own expense.
- C. Engineer reserves the right to direct the Contractor to use blank riser sections in lieu of sections with pre-cast holes, should unknown site conflicts require field cutting of concrete for the connection of laterals.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS, AND EQUIPMENT.
- 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 directed by the Owner to dispose off site.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Precast Bases, Risers, and Tops: catch basins shall be constructed as per the requirements specified for manholes in Section 02252 – MANHOLES.
 1. Catch basins shall be constructed as detailed. Catch basins shall be designed for a minimum of H-20 loading. Catch basins shall have a minimum of 6 ft sump depth, unless otherwise noted.
- B. Concrete: catch basins shall be constructed as per the requirements specified for manholes in Section 02252 – MANHOLES.
- C. Frames and Grates:

1. 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.
2. Frames and Grates shall be Cast Iron, conforming to ASTM A48, Class 35B and as follows:
 - a. Castings to be free from scale, lumps, blisters and sandholes.
 - b. Machine contact surfaces to prevent rocking.
 - c. Thoroughly clean and hammer inspect.
3. Frames and grates shall be capable of withstanding AASHTO H-20 loading unless otherwise indicated or specified.
4. Catch Basin Grates Shall be waffle type similar to a style typified by East Jordan Iron Works (Series 5520M5), or approved equal.
5. Single Catch Basin Frames (3 flanged) shall be similar to a style typified by East Jordan Iron Works (Series 5523) or approved equal.
7. Single Shallow Inlet Catch Basin Frames (3 flanged) shall be similar to a style typified by East Jordan Iron Works (Series 5525), or approved equal.
8. Plaza Area Drain Inlet shall be similar to a style typified by Nyloplast (Series 0601DI – 6-inch Drop-In Grate), or approved equal.

D. Hoods

1. For round structures, Catch Basin Hoods shall be similar to a style typified by East Jordan Iron Works (Series 5902), or approved equal.
2. For square structures, Catch Basin Hoods with inserts shall be similar to a style typified by E. L. LeBaron Foundry Co. (Model L-205, acquired by East Jordan Iron Works), or approved equal. If cast iron inserts of this type are not available, composite hoods shall be used (Eliminator by Ground Water Rescue, Inc.).

E. NO DUMP Curb Markers

1. No-dump markers shall be installed on all existing-to-remain, or proposed catch basins and inlets within the project area unless otherwise indicated in the catch basin schedule on the Drawings. Curb

markers shall be similar to a style typified by East Jordan Iron Works (Series 7267) or approved equal.

2. “Don’t Dump” Placards – This Section shall include the installation of Coast 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 Contractor for installation adjacent to sidewalk.
- F. Jointing: catch basin jointing shall be as per the requirements specified for manholes in Section 02252 – MANHOLES.
- G. Gaskets: catch basin jointing shall be as per the requirements specified for manholes in Section 02252 – MANHOLES.
- H. Grout for Sealing Joints: catch basin sealing grout shall be as per the requirements specified for manholes in Section 02252 – MANHOLES.
- I. Mortar for Brickwork: catch basin brickwork mortar shall be as per the requirements specified for manholes in Section 02252 – MANHOLES.
- J. Brick: catch basin chimney bricks shall be as per the requirements specified for manholes in Section 02252 – MANHOLES.
- K. Waterproofing: catch basin waterproofing shall be as per the requirements specified for manholes in Section 02252 – MANHOLES.
- L. Bituminous Dampproofing: catch basin dampproofing shall be as per the requirements specified for manholes in Section 02252 – MANHOLES.
- M. Flexible Seals: catch basin pipe seals shall be as per the requirements specified for manholes in Section 02252 – MANHOLES.

PART 3 – EXECUTION

3.1 PROCUREMENT:

- A. In addition to riser sections identified in the pre-cast manufacturer’s clock drawings, procure an additional one each of every nominal height of 4-ft diameter riser section for use as blanks when field cutting openings for pipe connections.

3.2 HANDLING:

- A. Handle catch basin sections as per the requirements specified for manholes in Section 02252 – MANHOLES.

3.3 INSPECTION

- A. Inspect catch basins sections as per the requirements specified for manholes in Section 02252 – MANHOLES.

3.4 INSTALLATION

- A. Install catch basins sections as per the requirements specified for manholes in Section 02252 - MANHOLES.

3.5 BACKFILLING

- A. Backfill catch basins sections as per the requirements specified for manholes in Section 02252 - MANHOLES.

3.6 INSTALLING HOODS AND TRAPS

- A. Hoods shall be built into the catch basin wall, shall be watertight, and shall be installed in conformance with the manufacturer’s instructions.
- B. Hoods with Inserts shall be built into the catch basin wall and into the pipe, shall be water tight and shall be installed in conformance with the manufacturer’s instructions.

3.7 INSPECTION AND TESTING

- A. Inspect and test catch basins as per the requirements specified for manholes in Section 02252 – MANHOLES.

3.8 CLEANING

- A. Clean catch basins as per the requirements specified for manholes in Section 02252 – MANHOLES.

3.9 NO DUMP CURB MARKERS INSTALLATION

- A. “No Dumping” curb markers shall be installed at all existing-to-remain or proposed catch basins and inlets unless otherwise indicated in the catch basin schedule on the Drawings.

PART 4 – COMPENSATION

Item 2604.1 --- Catch Basin – Type 1 Single Grate (4-foot Diameter)

Item 2604.2 --- Catch Basin – Type 5 Direct Inlet

Item 2604.3 --- Catch Basin – Type 3 Single Grate (3’x4’)

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, cleaning, and leakage testing/inspection of precast concrete catch basin complete as indicated on the Drawings and Specifications, or as directed by the Owner or Engineer. This work shall include furnishing, installing, and/or performing the following: gravel pavement subbase; pavement or sidewalk sawcutting; removal of brick, concrete, or bituminous sidewalk; 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; removal of groundwater from the trench; handling groundwater recharged back to the soil; filter fabric as required; bedding, including compaction; precast concrete catch basin sections with frames, grates, masonry chimney, appurtenances, pipe sleeve (if applicable); furnish "No Dumping" curb placards for installation in adjacent to sidewalk; field coring of pipe connections; furnishing, placing and compacting suitable backfill soil; grade and compact gravel pavement sub-base; compaction testing; and all appurtenances and incidental work.

METHOD OF MEASUREMENT:

Payment for Precast Concrete Catch Basins shall be based on the Unit Price bid in the proposal. Measurement for payment shall be based on the actual number of complete and functional catch basins as shown on the Contract Drawings or as directed by the Owner or Engineer. **Assume catch basins to have a vertical depth of 12 feet as measured from inside bottom of base section to finished grade.**

Catch basins 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.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: disposal of bituminous concrete and construction debris; treatment of groundwater discharged under the DEP Dewatering Permit; procurement, installation, and compaction of CDF.

Item 2604.4 --- Plaza Area Drain Inlet and Riser

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 and installation of Plaza Area Drain Inlet and Riser complete as indicated on the Drawings and Specifications, or as directed by the Owner or Engineer. This work shall include furnishing, installing, and/or performing the following: paver or sidewalk sawcutting; removal of paver, concrete, or bituminous sidewalk; excavation of bituminous concrete roadway; transporting material to/from soil staging area; temporary excavation support; removal of groundwater from the trench; handling groundwater recharged back to the soil; filter fabric as required; bedding, including compaction; PVC riser sections, drain inlet grate, appurtenances; furnishing, placing

and compacting suitable backfill soil; grade and compact pavement sub-base; compaction testing; and all appurtenances and incidental work.

METHOD OF MEASUREMENT:

Payment for Plaza Area Drain Inlet and Riser shall be based on the Unit Price bid in the proposal. Measurement for payment shall be based on the actual number of complete and functional Plaza Area Drain Inlets and Risers as shown on the Contract Drawings or as directed by the Owner or Engineer.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: disposal of bituminous concrete and construction debris; treatment of groundwater discharged.

END OF SECTION 02604

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SECTION 02609

REINFORCED CONCRETE PIPE

2609.1 PIPE – RCP (GRAVITY) 48-INCH LINEAR FOOT

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section includes the following:

1. Furnishing, installing, and testing of precast concrete circular and elliptical pipe, complete and in place, within the limits and to the lines and grades indicated.

1.2 RELATED TECHNICAL SECTIONS

- A. Section 00825A – SPECIAL CONDITIONS
- B. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- C. Section 02252 – MANHOLES
- D. Section 02604 – CATCH BASINS

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01300 – SUBMITTALS:

1. Shop drawings of pipe and fittings,
2. Product data and certified dimensional drawings of all pipe, joints, bends, special fittings, and appurtenances,
3. Gasket and pipe manufacturer's joint assembly directions,
4. 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. Certification with each delivery, that pipe complies to this specification,

7. Anticipated production and delivery schedule,
8. Results of leakage tests performed prior to final paving.
 - a. Test results shall be logs maintained during Infiltration or Exfiltration Tests, or footage and logs of Close Circuit Television Inspection.

1.4 QUALITY CONTROL

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. Owner reserves right to inspect and test by independent services 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 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. Dimensions, Reinforcement, and Strength Requirements: The dimensions, reinforcing steel, and strength requirements of the pipe shall meet the requirements of ASTM C76, latest revision, for Wall "B", Class III and IV pipe and for Wall "C", Class V pipe and the

additional requirements specified herein. 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 meeting requirements of ASTM C443, latest revision, in all respects, and shall be of neoprene 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 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.

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 determined by boiling test described in ASTM C76, latest revision, shall not exceed 5.3 percent of dry weight.

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.

E. Reinforced Concrete Flared Pipe End

1. The flared pipe end shall be reinforced concrete, matching the ASTM C76 class of the adjoining reinforced concrete pipe. The concrete shall be of uniform high density and impermeability, free from any objectionable voids. The steel reinforcement shall be uniform and satisfying ASTM C76 requirements.
2. The pipe joint shall be compatible with the adjoining reinforced concrete pipe.

E. Reinforced Concrete Elliptical Pipe

1. Elliptical Concrete Pipe shall conform to ASTM C507.

PART 3 – EXECUTION

3.1 PIPE AND PIPE FITTINGS

- A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.
- B. 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.
- C. Laying Pipe: Except where a concrete cradle or envelope is required, all pipe greater than or equal to 18-inches 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.
- D. Jointing Pipe: After the pipe are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.
- E. 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.
- F. 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.
- G. For installation near crossing utilities and encasement requirements, refer to Contract Drawings.
- H. For Cast-In-Place concrete field closures, refer to Contract Drawings.
- I. For lateral service connections, refer to Contract Drawings.
- J. 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.
 - 1. Place plugs in end of uncompleted conduit at end of day or whenever work stops.
 - 2. Flush lines between manholes if required to remove collected debris.

- K. 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 directed. 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.

3.2. LEAKAGE TESTS

- A. Refer to Article 51 – “Leakage Tests” in Section 00825A – SPECIAL CONDITIONS.
- B. If Leakage Test method consists of visual or Close Circuit Television Inspection, the contractor shall perform 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) 48-Inch

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, cleaning, and leakage testing/inspection of precast concrete pipe complete as indicated on the 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; removal of loop detectors; removal of brick, concrete, or bituminous sidewalk; 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; sanitary sewer and storm drain flow handling; removal of groundwater from the trench; handling groundwater recharged back to the soil; filter fabric as required; bedding, including compaction; reinforced concrete pipe, fittings, couplings, and appurtenances; connecting existing and new laterals; connections to structures; furnishing, placing and compacting suitable backfill soil; grade and compact gravel pavement sub-base; compaction testing; and all appurtenances and incidental work.

METHOD OF MEASUREMENT:

Payment for Precast Concrete Pipe shall be based on the Unit Price bid in the proposal. Measurement for payment shall be based on the actual linear feet of complete and functional pipes as shown on the Contract Drawings or as directed by the Owner or Engineer. Measurement shall be taken 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.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: disposal of bituminous concrete and construction debris; treatment of groundwater discharged; procurement, installation, and compaction of CDF.

END OF SECTION 02609

SECTION 02615

DUCTILE IRON PIPE FOR SANITARY
AND STORM DRAIN GRAVITY

2615.1	PIPE – DI (GRAVITY) 10-INCH DIAMETER	LINEAR FOOT
2615.2	PIPE – DI (GRAVITY) 12-INCH DIAMETER	LINEAR FOOT

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes the following:

1. Furnishing, installing, and testing ductile-iron pipe and fittings for gravity sanitary sewers and storm drains complete in place within the limits and to the lines and grades indicated.
2. Furnishing, installing, and testing ductile-iron pipe and fitting for force mains associated with pump station complete as indicated and specified.

B. Options:

1. For joints in buried exterior pipelines, provide either push-on or mechanical-joint. All fittings and valves shall be mechanical joint.
2. Concrete Encasement: For sanitary sewer and/or storm drain installed above water pipe, see Details.
3. CDF Encasement: For shallow depth of cover at catch basins, see Details.

1.2 RELATED TECHNICAL SECTIONS

- A. Section 00825A – SPECIAL CONDITIONS
- B. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- C. Section 02252 – MANHOLES
- D. Section 02622 – POLYVINYL CHLORIDE PIPE
- E. Section 02640 – VALVES AND APPURTENANCES
- F. Section 02704 – PIPELINE PRESSURE LEAKAGE TESTING

G. Section 03300 – CONCRETE

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01300 - SUBMITTALS:

1. Shop drawings of pipe and fittings,
2. Product data and certified dimensional drawings of all pipe, joints, bends, special fittings, and appurtenances.
3. Gasket and pipe manufacturer's joint assembly directions,
4. 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. Certification with each delivery, that pipe complies to this specification,
7. Anticipated production and delivery schedule.
8. Results of leakage tests performed prior to final paving.
 - a. Gravity pipe test results shall be logs maintained during Infiltration or Exfiltration Tests, or footage and logs of Close Circuit Television Inspection.
9. Manufacturer's literature stating that the ductile iron pipe and fittings for force mains have been manufactured and tested in accordance with AWWA/ANSI specifications.
10. Detailed description of proposed pressure testing procedures to be used for force mains. The description shall contain the name of the person responsible for pressure testing, and equipment to be used. 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 CONTROL

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. Owner reserves right to inspect and test by independent services 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 GENERAL

- A. Listed Manufactures:

1. US Pipe and Foundry Company,
2. Griffin Pipe Products Company,
3. American Cast Iron Pipe Company,
4. or equal.

2.2 DUCTILE IRON PIPE

- A. 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 conforming to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51.
- B. The ductile iron pipe shall be Class 52 and furnished in nominal 18-foot lengths. For shallow installations, Class 53 shall be used where indicated in the Details.
- C. The ductile iron pipe shall be unlined inside, and asphalt seal coated where used for drainage or gravity service. The pipe shall be furnished along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.

2.3 FITTINGS

- A. Fittings shall be manufactured in the United States and shall be compact ductile iron Class 350 Mechanical Joint, conforming to ANSI/AWWA C153/A21.53, latest edition, for pipe sizes 16 inches and smaller. Pipe sizes larger than 16 24 inches shall be Class 350 standard Mechanical Joint fittings conforming to ANSI/AWWA C110/A21.10, latest edition except as specified, or indicated on the drawings. Fittings shall be suitable for use with restraints as specified hereinafter.
- B. 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.

- C. 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.
- D. Solid sleeves shall be ductile iron with 350 psi rating. Sleeves shall conform to ANSI/AWWA C110/A21.1.

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. Joining two classes of pipe may be of lighter class provided annular space in bell-and-spigot type joints sufficient for jointing.

2.5 JOINTS

- A. Provide mechanical joint or push-on joint pipe with necessary accessories, conforming to ANSI/AWWA C111/A21.11.
- B. Provide gasket composition suitable for exposure to liquid within pipe.
- C. Restrained joints shall be furnished for installation on all fittings, sleeves, hydrants and valves.
 - 1. Restraints for mechanical joints shall be:
 - a. Uni-flanged Series 1400 by Ford Meter Box,
 - b. Stargrip Series 3000 by Star Pipe Products,
 - c. or equal.
 - 2. Restraints for push-on joints shall be:
 - a. Uni-Flange Series 1390 by Ford Meter Box,
 - b. Stargrip Series 3100 by Star Pipe Products,
 - c. or equal.

2.6 COUPLINGS

- A. For gravity applications, couplings shall be shielded flexible type in

accordance with Section 02622 – POLYVINYL CHLORIDE PIPE.

- B. For pressure applications, couplings shall be solid sleeve type as follows:
 - 1. Pressure rating at least equal to that of related pipeline with a minimum rating of 150 psi. Couplings shall be provided with; steel sleeve that is fusion bonded epoxy coating; 2 steel followers; 2 nitrile rubbed gaskets; and steel bolts.
 - 2. Couplings shall be similar to a style typified by Style 441 manufactured by Smith Blair, Inc, or an approved equal.

2.7 CONNECTIONS - TAPPED

- A. Provide watertight joint with adequate strength against pullout. Use only tapered thread taps. 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: 2 full threads for ductile iron.
- B. 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.

2.8 STANDARD LINING AND COATING

- A. Inside of pipe and fittings: Provide double thickness cement lining and bituminous seal coat conforming to ANSI/AWWA C104/A21.4.
- B. Outside of other pipe and fittings: Standard bituminous coating conforming to appropriate ANSI Standard.

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 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/°F/ft². 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.

- 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.
- C. Insulation shall be manufactured by:
 - 1. Thermal Pipe Systems, Inc,
 - 2. Insul Tek Piping Systems, Inc,
 - 3. Tricon Piping Systems, Inc,
 - 4. or equal.

2.11 THRUST BLOCKING

- A. Where applicable or directed, reaction or concrete thrust blocks shall be furnished at all tees, plus bends as directed or as detailed on drawings with 3,000 psi, 1-1/2, 470 cement concrete masonry. 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 primary means of restraint shall consist of a mechanical joint restraint or push-on joint restraint as specified.

2.12 SERVICE CONNECTIONS

- A. For gravity service lateral connections, refer to Section 02622 – POLYVINYL CHLORIDE PIPE.

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.
- 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. For installation near crossing utilities and encasement requirements, refer to Contract Drawings.
- B. 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.
- C. Installation and jointing of push-on ductile iron pipe shall be in accordance with AWWA C600 Sections 9b and 9c, latest revision, as applicable.
- D. Mechanical joints for force mains: Restraints shall be installed in full accordance with the manufacturers' instructions. All bolt heads shall be tightened sufficiently so that they shear off to provide indication that proper tightening torque was achieved (if applicable).
- E. Ductile iron pipe installed within 5 feet of gas lines or within areas subject to corrosive soils or waters shall be fully encased with polyethylene material. Polyethylene shall be 8-millimeters thick and comply with AWWA C-105.
- F. Insulated pipe with jacket is to be installed where shown on the drawings and on any pipe having less than 4-foot cover.
- G. Solid sleeves shall be used to join plain ends on ductile iron pipe. Mechanical joints shall be installed as specified herein before.

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. Socket Pipe Clamps, Tierods, and Bridles: Where indicated or necessary to prevent joints or sleeve couplings from pulling apart under pressure, provide suitable socket pipe clamps, tierods, and bridles. Use bridles and tierod at least 3/4 in. in diameter except where they replace flange bolts of smaller size with nut on each side of flange pairs. Coat clamps and tierods or bridles with two coats of bituminous coating after assembly and allow to dry before backfilling.
- D. 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.

C. Sleeve-Type Coupling:

1. Clean pipe ends for distance of 8 inches.
2. Use soapy water as gasket lubricant.

3. Slip follower and gasket over each pipe to a distance of 6 inches 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:

TORQUE

Nominal pipe size (inches)	Bolt diameter (inch)	Range of torque (ft-lb)
3/24	5/8	75
30-36 (1/2 in. mid ring) (3/8 in. mid ring)	5/8 5/8	75 65
30-48	3/4	70
48-72	3/4	70

7. After assembly and inspection and before backfill, coat exterior surfaces of buried couplings with heavy-bodied bituminous mastic.

D. Tapped Connection:

1. Drill and tap normal to longitudinal axis.
2. Drilled by skilled mechanics using proper tools.
3. Use only tapered threads.

E. Joining to Existing Pipe:

1. For connecting proposed pipe to existing pipe, refer to Details.

F. Service Connections:

1. For connection of laterals to proposed or existing pipe, refer to Details.

3.5 TESTING

- A. Refer to Article 51 – “Leakage Tests” in Section 00825A – SPECIAL CONDITIONS.

- B. If Leakage Test method consists of visual or Close Circuit Television Inspection, the contractor shall perform 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 2615.1 --- Pipe – DI (Gravity) 10-Inch Diameter

Item 2615.2 --- Pipe – DI (Gravity) 12-Inch Diameter

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, cleaning, and leakage testing/inspection of ductile iron pipe complete as indicated on the Drawings and Specifications, or as directed by the Owner or Engineer. This work shall include furnishing, installing, and/or performing the following: gravel pavement subbase; pavement or sidewalk sawcutting; removal of looped detectors; removal of brick, concrete, or bituminous sidewalk; 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; sanitary sewer and storm drain flow handling; removal of groundwater from the trench; handling groundwater recharged back to the soil; filter fabric as required; bedding, including compaction; ductile iron pipe, fittings, couplings, and appurtenances; connecting existing and new laterals; connections to structures; furnishing, placing and compacting suitable backfill soil; grade and compact gravel pavement sub-base; compaction testing; and all appurtenances and incidental work.

METHOD OF MEASUREMENT:

Payment for Pipe – DI (Gravity) 10-Inch and 12-Inch Diameter shall be based on the Unit Price bid in the proposal. Measurement for payment shall be based on the actual linear feet of complete and functional pipes as shown on the Contract Drawings or as directed by the Owner or Engineer. Measurement shall be taken 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.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: disposal of bituminous concrete and construction debris; treatment of groundwater discharged; procurement, installation, and compaction of CDF; ductile iron pipe used for water pipe.

END OF SECTION 02615

SECTION 02622

POLYVINYL CHLORIDE PIPE

2622.1	RECONNECT, REPAIR, OR RELOCATE EXISTING SANITARY SEWER AND STORM DRAIN LATERALS	LINEAR FOOT
2622.2	PIPE – PVC (GRAVITY) 6-INCH PERFORATED	LINEAR FOOT
2622.3	PIPE – PVC (GRAVITY) 6-INCH	LINEAR FOOT
2622.4	PIPE – PVC (GRAVITY) 8-INCH	LINEAR FOOT
2622.5	PIPE – PVC (GRAVITY) 10-INCH	LINEAR FOOT
2622.6	PIPE – PVC (GRAVITY) 12-INCH	LINEAR FOOT
2622.7	PIPE – PVC (GRAVITY) 18-INCH	LINEAR FOOT

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This Section includes the following:
 - 1. Furnishing, installing, and testing of PVC pipe and fittings complete and in place, within the limits and to the lines and grades indicated.

1.2 RELATED TECHNICAL SECTIONS

- A. Section 00825A – SPECIAL CONDITIONS
- B. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- C. Section 02252 – MANHOLES
- D. Section 02640 – VALVES AND APPURTENANCES

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTALS:
 - 1. Shop drawings of pipe and fittings,
 - 2. Product data and certified dimensional drawings of all pipe, joints, bends, special fittings, and appurtenances.

3. Gasket and pipe manufacturer's joint assembly directions,
4. 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. Certification with each delivery, that pipe complies to this specification,
7. Anticipated production and delivery schedule.
8. Results of leakage tests performed prior to final paving.
 - a. Test results shall be logs maintained during Infiltration or Exfiltration Tests, or footage and logs of Close Circuit Television Inspection.

1.4 QUALITY CONTROL

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. Owner reserves right to inspect and test by independent services 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 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 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:
2. Non Perforated 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. Perforated PVC pipe shall conform to the requirements of ASTM D 3034, Class SDR 35. Material for perforated PVC pipe shall conform to the requirements of ASTM D 1784 for Class 12454-B or 12454-C as defined therein. The pipe shall have 3/8-inch to 1/2-inch perforations, 6-inch on-center top and sides. The pipe shall be 6 inches in diameter unless otherwise specified on the Contract Drawings.
5. Elastomeric seals for compression type joints for PVC pipe and fittings shall conform to the requirements of ASTM D 3212.
6. Service pipes for storm services shall be minimum of 6 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 acceptable in accordance with Figure 02622 A and Figure 02622 B. Inserta-tees may be used only where approved by the Engineer and if allowed, shall be cast in 6-inches of concrete.

D. Shielded Flexible Couplings

1. General

- a. Shielded flexible couplings shall be used to connect sewer and drain pipe. Typical applications are where new pipe connects to existing pipe or a pipe with dissimilar material or size.
- b. Non-shielded flexible couplings are permitted for sewer and drain service laterals 6-inch in diameter or less.
- c. Couplings and shields shall be sized to fit the outer diameter of pipe, and be rated for the pipe material and conditions of service by the manufacturer.
- d. Eccentric couplings shall be used where connecting pipes of different nominal diameter.
- e. The CONTRACTOR will not be allowed to substitute any other type of coupling unless approved by the ENGINEER.

2. Construction

- a. Flexible couplings shall be in accordance with ASTM C1173 – Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
- b. Rubber sleeves shall be rated for heavy earth loads and be immune to attack by chemicals and impurities normally found in water or wastewater.
- c. Shields shall consist of a rigid stainless steel shear ring.
- d. Bolts, nuts, straps, and all miscellaneous hardware shall be Type 316 stainless steel.

3. Manufacturer

- a. Shielded flexible couplings shall be Fernco (5000 Repair series), Mission Rubber (Flex-Seal Repair series), Indiana Seal (Heavy Duty Repair series) or approved equal.
- b. Non-shielded flexible couplings shall be Fernco (Stock and Eccentric series), Mission Rubber (Flex Seal Stock series), Indiana Seal (Stock series) or approved equal.

E. Service Connections

1. Sanitary services shall be connected to new, parallel, replacement or existing sanitary sewer lines with full bodied tees, wye fittings, saddle-type tees in accordance with the following:

- a. For 6-inch dia. sanitary services to 15-inch dia or less sanitary sewer mainlines a saddle type (Romac Style CB or equal) or full bodied fitting with solid transition coupling shall be used;
 - b. For 8-inch dia. sanitary services to existing 12-inch dia or less sanitary sewer mainlines a full bodied fitting with solid transition coupling shall be used;
 - c. For 8-inch dia. sanitary services to new 15-inch dia or less sanitary sewer mainlines a full bodied fitting with solid transition coupling shall be used;
 - d. For 10-inch dia. sanitary services consult with engineer; and
 - e. Otherwise reference Figure 02622 A.
2. Storm services shall be connected to new, parallel, replacement or existing storm drain mainlines with full bodied tees, wye fittings, saddle-type tees in accordance with the following:
- a. For 6-inch dia. storm services to 15-inch dia. or less storm drain main lines a saddle type (Romac Style CB or equal) or a full bodied fitting with solid transition couplings is required.
 - b. For 8-inch dia. storm services to 15-inch dia. or less storm drain mainlines a full bodied fitting with solid transition coupling is required.
 - c. For 10- and 12-inch dia. storm services to storm drain mainlines consult with engineer; and
 - d. Otherwise reference Figure 02622 B.

Figure 02622 A

Service Connection On New Mainline Pipes
Dia. of Mainline Pipe

Service Dia.	8"	10"	12"	15"	18"	21"	24"
New Sanitary Sewer							
6"*	FB/S	FB/S	FB/S	FB/S	FB/S	FB/S	FB/S
8"	FB	FB	FB	FB	FB/S	FB/S	FB/S
10"	C	C	C	C	C	C	C
New Storm Drain							
6"*	FB/S	FB/S	FB/S	FB/S	S	S	S

8-10"	C	FB / C	FB / C	FB / C	FB / C	FB/ C	FB/ C
12"	C	C	FB / C	FB / C	FB / C	FB / C	FB/C

Note: In every situation a full body fitting is acceptable
 * Minimum allowable service diameter
 C: consult engineer
 FB: full bodied fitting required
 S: saddle

Figure 02622 B

Service Connection On Existing Mainline Pipes

Dia. of Mainline Pipe

Service Dia.	Existing Sanitary Sewer							
	8"	10"	12"	15"	18"	21"	24"	
6"*	FB/S	FB/S	FB/S	FB/@	S	S	S	
8"	FB	FB	FB	IT w/ CE	S	S	S	
10"	C	C	C	C	C	C	C	
	Existing Storm Drain							
6"*	FB/S	FB/S	FB/S	FB/S	s	S	S	
8-10"	C	FB	FB	FB	FB	S	S	
12"	C	C	FB	FB	FB	FB	C	

Note: In every situation a full body fitting is acceptable
 * Minimum allowable service diameter
 C: consult engineer
 FB: full bodied fitting required
 S: saddle

F. 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.

G. Gaskets

1. Gaskets shall be flexible elastomeric rings conforming with ASTM F 477.

PART 3 – EXECUTION

3.1 PIPE AND PIPE FITTINGS

- A. 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.
- B. 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.

3.2 INSTALLATION

- A. Install PVC pipe and fittings in accordance with manufacturer's printed instructions.
- B. No pipe or fitting shall be permanently supported on saddles, blocking, or stones. Bedding material shall be as specified in Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
- C. 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.
- D. 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.
- E. 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 as to wedge apart and split the bell or groove ends. Joints shall not be "pulled" or "cramped" unless permitted by the Engineer. The resulting joints shall be watertight and flexible.

- F. 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.
- G. Allowable Pipe Deflection
 - 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.
- H. Open ends of pipe and branches shall be closed with polyvinyl chloride stoppers secured in place in an acceptable manner.
- I. After each pipe has been properly bedded, enough bedding material 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 bedding material and compacted, and additional material shall be placed and compacted to complete the pipe bedding.
- J. 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.
 - 1. 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.

- K. For installation near crossing utilities and encasement requirements, refer to Contract Drawings.
- L. For lateral service connections and encasement requirements, refer to Contract Drawings.
- M. 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.
- O. Shielded Flexible Couplings
 - 1. Where couplings are used, plain ends of pipe shall be made smooth and round for a distance of 12 inches from the ends of the pipe, with an outside diameter not more than 1/64 inch smaller than the manufactured outside diameter of pipe. Install couplings per manufacturer's written instructions.
 - 2. SPARE PARTS - CONTRACTOR shall maintain an on-site inventory of couplings suitable for use with the various nominal diameters and materials of proposed and existing pipe referenced in the CONTRACT DOCUMENTS. CONTRACTOR shall be responsible to verify the outer diameter of pipe in advance through measurements taken at access manholes and test pits. The lead times for fabrication, stocking and shipping of couplings shall not be cause for delay or the use of other types of couplings.

3.3. LEAKAGE TESTS

- A. Refer to Article 51 – “Leakage Tests” in Section 00825A – SPECIAL CONDITIONS.
- B. If Leakage Test method consists of visual or Close Circuit Television Inspection, the contractor shall perform 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 2622.1 --- Reconnect, Repair, or Relocate Existing Sanitary Sewer and Storm Drain Laterals

Item 2622.2 --- Pipe – PVC (Gravity) 6-Inch Perforated

Item 2622.3 --- Pipe – PVC (Gravity) 6-Inch

Item 2622.4 --- Pipe – PVC (Gravity) 8-Inch

Item 2622.5 --- Pipe – PVC (Gravity) 10-Inch
Item 2622.6 --- Pipe – PVC (Gravity) 12-Inch
Item 2622.7 --- Pipe – PVC (Gravity) 18-Inch

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, cleaning, and leakage testing/inspection of polyvinyl chloride pipe complete as indicated on the Drawings and Specifications, or as directed by the Owner or Engineer. This work shall include furnishing, installing, and/or performing the following: gravel pavement subbase; roadway or sidewalk sawcutting; removal of loop detectors; removal of brick, concrete, or bituminous sidewalk; 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; sanitary sewer and storm drain flow handling; removal of groundwater from the trench; handling groundwater recharged back to the soil; filter fabric as required; bedding, including compaction; polyvinyl chloride pipe, fittings, couplings, adapters and appurtenances; connecting existing and new laterals; connections to structures; cleanout assemblies (if required); placing and compacting suitable backfill soil; grade and compact pavement subbase; compaction testing; and all appurtenances and incidental work.

METHOD OF MEASUREMENT:

Payment for Polyvinyl Chloride Pipe shall be based on the Unit Price bid in the proposal.

Measurement for payment of items 2622.1 through 2622.7 shall be based on the actual linear feet of complete and functional pipes as shown on the Contract Drawings or as directed by the Owner or Engineer. Measurement shall be taken 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.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: disposal of bituminous concrete and construction debris; treatment of groundwater discharged; procurement, installation, and compaction of CDF.

END OF SECTION 02622

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) 12-INCH	LINEAR FOOT

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnishing and installing ductile-iron pipe and fittings, as indicated and specified.
- B. Options:
 - 1. For joints in buried exterior pipelines, provide push-on joints.
 - 2. Joints within 10-foot horizontally from any existing or proposed sewer and/or any sewer crossing within 18-inches below, shall be restrained joints (in addition to joints as identified in the enclosed restraint table based on their proximity to bends, valves, tees, reducers and dead ends).
 - 3. All fittings and valves shall be mechanical joint.
- C. Related sections include the following:
 - 1. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
 - 2. Section 02640 – VALVES AND APPURTENANCES
 - 3. Section 02645 – HYDRANTS
 - 4. Section 02660 – WATER SERVICES
 - 5. Section 02675 – DISINFECTION OF WATER MAINS
 - 6. Section 02704 – PIPELINE PRESSURE AND LEAKAGE TESTING

E. Permits:

1. Section 01060 – PERMITS AND REGULATORY REQUIREMENTS

2. 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 (using 2 swing ties per item from existing building corners, existing gate valves, and/or existing hydrants only) to all new water main gate valves, Tee's and elbows*, required CWD “sign offs” 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.

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. Perform disinfection and pressure testing of installed mains as specified in Sections 02675 and 02704.

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 AWWA C150-09 (ANSI A21.50) and AWWA C151-09 (ANSI A21.51).
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, Griffin Pipe Co., or equal with gaskets conforming to AWWA C111-12 (ANSI A21.11) "Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings".
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 C104-08 (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 new 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 24-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 COR-TEN 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 the same pressure rating as the fittings. Sleeves shall conform to ANSI/AWWA C110. Contractor shall verify outside diameter of cast iron pipe to determine compatibility with standard mechanical joint solid sleeves. Couplings shall be used when existing cast iron pipe is incompatible with solid sleeve.

2.3 JOINTS

- A. Provide mechanical joint, push-on joint, or flanged pipe with necessary accessories, conforming to AWWA C111-12 (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 gasket composition suitable for exposure to fluctuating groundwater conditions.
- B. Provide pipe flanges and accessories conforming to AWWA C115-11 (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., or Series 1390 as manufactured by Uni-Flange 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; Dresser 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. For connections to existing cast iron pipe:
 - 1. Contractor shall verify coupling model is compatible with outside diameter of cast iron pipe.
 - 2. Restrained couplings shall be provided where indicated on the Drawings or where location is within a required restrained length of water main as indicated in Part 3 of this Section. Couplings shall be restrained using friction clamps and tie rods. For 24-inch diameter cast iron water mains, Contractor shall provide (4) friction clamps and (4) 1-1/4" rods. Rods, friction clamp washers, and heavy hex nuts shall be AISI 316 series stainless steel manufactured in the United States in accordance with ASTM A193 grade B8M class 1. Where 316 stainless steel is not available the Contractor shall provide fusion bonded epoxy coated hardware. Tie rods shall be double nutted on each end.

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 and outside of pipe and fittings: Provide 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 C104-08 (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,
 - 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.
- C. Number and size of bolts conform to same ANSI 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 BTU/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 preformed 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.
- C. Insulation shall be provided for pipes that are shallower than 5 feet of cover.

2.11 THRUST BLOCKING

- A. Where applicable, reaction or concrete thrust blocks shall be furnished at all anchor tees, plus bends as required or as detailed on drawings with 3,000 psi, 1-1/2, 470 cement concrete masonry. 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:

Lengths shown are based on 150 psi test pressure, 4-foot bury, soil type GP, trench Type 3, a 4-foot low side depth, and 2:1 safety factor. Changes in conditions will require revision in lengths.

MINIMUM RESTRAINED LENGTHS

<u>Fitting</u>	<u>Restrained Length</u>
12" - 45° Bend	15-feet in each Direction
12" - 22.5° Bend	8-feet in each Direction
12" - 11.25° Bend	4-feet in each Direction
10" - 45° Bend	13-feet in each Direction
10" - 22.5° Bend	6-feet in each Direction
10" - 11.25° Bend	3-feet in each Direction
8" - 45° Bend	11-feet in each Direction
8" - 22.5° Bend	6-feet in each Direction
8" - 11.25° Bend	3-feet in each Direction
6" - 45° Bend	8-feet in each Direction
6" - 22.5° Bend	4-feet in each Direction
6" - 11.25° Bend	2-feet in each Direction
12" Vertical Offset	
Upper	49-feet in each Direction
Lower	15-feet in each Direction
10" Vertical Offset	
Upper	23-feet in each Direction
Lower	13-feet in each Direction
8" Vertical Offset	
Upper	19-feet in each Direction
Lower	11-feet in each Direction
6" Vertical Offset	
Upper	15-feet in each Direction
Lower	8-feet in each Direction
12" x 12" x 12" Tee	65-feet along Branch
12" x 12" x 8" Tee	46-feet along Branch
12" x 12" x 6" Tee	35-feet along Branch
10" x 10" x 10" Tee	55-feet along Branch
10" x 10" x 8" Tee	46-feet along Branch
10" x 10" x 6" Tee	35-feet along Branch
8" x 8" x 8" Tee	46-feet along Branch
8" x 8" x 6" Tee	35-feet along Branch
6" x 6" x 6" Tee	35-feet along Branch
12" Valve or Dead End	65-feet back from valve or dead end
10" Valve or Dead End	55-feet back from valve or dead end
8" Valve or Dead End	46-feet back from valve or dead end
6" Valve or Dead End	35-feet back from valve or dead end
10" x 8" Reducer	19-feet back from fitting
10" x 6" Reducer	34-feet back from fitting
8" x 6" Reducer	16-feet back from fitting

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.
3. In locations where connecting new pipe to existing pipe; the contractor shall restrain the sections of existing water mains that are being connected to new work.

B. Pipe and Fittings:

1. Contractor shall take all necessary precautions to minimize contamination of water mains while storing, handling and installing the water mains prior to disinfection. The interiors of pipes, fittings and valves shall be kept clean and dry.
2. When storing or stringing pipe on-site, Contractor shall take all necessary precautions to ensure no foreign materials enter the water mains. Contractor shall ensure pipe is not stored on-site longer than 1-week prior to installation to minimize the risk of contamination.
3. If dirt enters the water mains upon installation, material shall be removed and the interior of the pipe cleaned with a 1 to 5 percent hypochlorite solution.
4. Remove and replace defective pieces.
5. Clear of all debris and dirt before installing and keep clean until accepted.
6. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.
7. Provide firm bearing along entire length of buried pipelines.
8. 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 two (2) feet, vertical distance shall be no less than one (1) foot, and no less than ten (10) feet from a sanitary sewer or surface water drain unless pre-approved by the Cambridge Water Department.

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 2630.1 - Pipe – DI (Water) 4-inch

Item 2630.2 - Pipe – DI (Water) 6-inch

Item 2630.3 - Pipe – DI (Water) 8-inch

Item 2630.4 - Pipe – DI (Water) 12-inch

METHOD OF MEASUREMENT:

Measurement for payment for items 2630.1, 2630.2, 2630.3 and 2640.4 will be based on the actual linear feet of pipe installed, tested, and accepted, completed 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 items 2630.1, 2630.2, 2630.3 and 2640.4 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; dewatering; furnishing and placing backfill per one of the approved methods; furnish, install and compact gravel road sub-base; furnish and install all fittings, couplings, and restraints as specified; 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; transporting material to/from soil staging area; furnish, install, and compact bedding; furnish and install ductile iron pipe, adaptors, transitions, gaskets and appurtenances; connections to existing and proposed pipes and structures; blow-offs; corporation stops for chlorination, testing, and flushing; chlorination, flushing and testing; disposal of testing materials; furnish and install pipe encasement or insulation as necessary; protective coating; and all work incidental to the installation of Ductile Iron Water Pipe, not specifically included for payment elsewhere.

END OF SECTION 02630

SECTION 02640

VALVES AND APPURTENANCES

2640.1	4-IN GATE VALVE AND GATE BOX	EACH
2640.2	6-IN GATE VALVE AND GATE BOX	EACH
2640.3	8-IN GATE VALVE AND GATE BOX	EACH
2640.4	12-IN GATE VALVE AND GATE BOX	EACH
2640.5	REMOVE AND REPLACE WATER CURB BOX	EACH
2640.6	EXISTING WATER VALVE BOX STRUCTURE 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.
- B. Section 01060 – PERMITS AND REGULATORY REQUIREMENTS
 - 1. 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 (2 ties per item from existing building corners, existing gate valves, and/or existing hydrants only) 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.”

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.
 2. Certification that all brass goods and valve materials in contact with potable water comply with the Safe Drinking Water Act Lead Reduction law and comply with NSF Standard 372.

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. Valve materials in contact with potable water shall be lead free with lead level not exceeding 0.25%. Materials shall comply with the Safe Drinking Water Act Lead Reduction law and with NSF Standard 372.
- C. 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 (clockwise). Operating nuts shall be painted red indicating open right. Valves installed with greater than 6'-0" of cover shall be provided with valve operating stem extensions per pre-approval of the Cambridge Water Department.
- D. Resilient gate valves shall meet the most recent version of the AWWA standard specification AWWA C509.
- E. Resilient wedge valves shall have mechanical joint ends and shall be equal to ANSI/AWWA C11/A21.11.

- G. Valves shall be Mueller A-2360 or approved equal.
- 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 TAPPING SLEEVES AND VALVES

- A. Tapping sleeves shall be mechanical joint type and shall be Mueller H-615, American Darling 1004 or approved equivalent.
- B. Valve materials in contact with potable water shall be lead free with lead level not exceeding 0.25%. Materials shall comply with the Safe Drinking Water Act Lead Reduction law and with NSF Standard 372.
- C. Tapping valves shall meet the requirements of AWWA C500. The valves shall be flanged by mechanical joint outlet with non-rising stem and designed for vertical burial. Tapping valves shall be rated at 200 psi working pressure and shop tested at 300 psi. Bolts on bonnet and stuffing box shall be stainless steel (316 stainless steel); stuffing boxes shall be "O" ring type. The operating nut shall be 2-inches square. The valve shall be provided with oversized seat to permit use of full size cutters. Gaskets shall cover the entire flange surface. Valves shall open right (clockwise). Valves installed with greater than 6' of cover shall be provided with valve operating stem extensions per pre-approval of the Cambridge Water Department.

2.3 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 coarse "rope" thread to enable quick and easy removal.
- C. Required Brass Goods shall include Corporation Cocks, Curb Stops, and Misc. Couplings and Fittings. Brass good materials in contact with potable water shall be lead free with lead level not exceeding 0.25%. Materials shall comply with the Safe Drinking Water Act Lead Reduction law and with NSF Standard 372. 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 Ford Model B44-444-Q or approved equivalent by Mueller. Corporation cocks shall be Ford Model FB-1000-4 or approved equivalent by Mueller.

- D. Washers shall be of cast bronze containing not less than 85 percent copper finished on both sides of true faces.
- E. All curb stops shall be subjected to a sustained hydraulic pressure of 300 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 be Dresser Style 88, or equivalent.
- H. The proper use of tapping equipments, corporations and Polytetra Fluoroethylene (Teflon) thread sealant tape shall be used. Do not use liquid thread sealants.

2.4 VALVE INSULATION

- A. The valve shall be insulated as required by the Engineer and as detailed on the drawings. Insulation shall be cellular glass insulation (Foamglas or equal) with jacketing (Pittwrap, or equal). It shall be structurally strong, corrosion and moisture resistant, vermin proof, fireproof and suitable for burial. 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.
- B. All materials and applications work shall be furnished by Pittsburgh Corning Corporation, or equivalent.

2.5 VALVE BOXES

- A. Valve boxes shall be provided for each valve.
- B. Valve boxes shall be ductile iron and of the telescopic design with two piece construction, a top with a cover and a bottom. The top section shall have a top flange to increase the stability of the box to remain at the present height. The lower section of the box shall have a bell shaped bottom designed to enclose the operating nut and stuffing box of the valve without settling. The valve box shall come complete with a cover on which the word "WATER" shall be cast. The cover of the valve box shall be close fitting and substantially dirt tight and flush with the top of the box rim. Gate boxes shall be installed for each buried valve.
- C. Valve boxes shall be straight, plumb, and centered over valve.

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.
- D. Butterfly valves shall be pressure tested for 15 minutes on ground prior to installation.

3.3 TAPPING SLEEVE AND VALVE

- A. Tapping sleeve and valves shall be installed in accordance with specification Section 02647.

3.4 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.

3.5 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.

3.6 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.
- B. Valve boxes shall be exposed always. Burying of valve boxes shall not be allowed.

3.7 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.

PART 4 – COMPENSATION

2640.1 --- 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; 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; transporting material to/from soil staging area; 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; and all incidental work required for the installation of 4-in gate valves and boxes not specifically included for payment elsewhere.

2640.2 --- 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; 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; transporting material to/from soil staging area; 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; and all incidental work required for the installation of 6-in gate valves and boxes not specifically included for payment elsewhere.

2640.3 --- 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; furnish and install gate valve; furnishing and placing backfill by one of the approved methods; transporting material to/from soil staging area; 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; and all incidental work required for the installation of 8-in gate valves and boxes not specifically included for payment elsewhere.

2640.4 --- 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; furnish and install gate box; furnishing and placing backfill by one of the approved methods; transporting material to/from soil staging area; 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; and all incidental work required for the installation of 12-in gate valves and boxes not specifically included for payment elsewhere.

2640.5 --- Remove and Replace Water Curb Box

METHOD OF MEASUREMENT:

Measurement for payment for Removal and Replacement of Water Curb Boxes will be based on the actual number of curb boxes removed and replaced, complete as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for Removal and Replacement of Water Curb 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 remove and replace each curb box completed 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 gate box; furnishing and placing backfill by one of the approved methods; transporting material to/from soil staging area; compaction; compaction testing; temporary excavation support furnished and installed complete; furnishing, installing and compacting bedding; furnish, remove and install curb box; concrete setting bed for the curb box; support of gate valve during installation; and all incidental work required for the removal and replacement of water curb boxes not specifically included for payment elsewhere.

2640.6 --- Existing Water Valve Box Structure Adjusted

METHOD OF MEASUREMENT:

Payment for Existing Water Valve Box Structure Adjusted shall be based on the Unit Price bid

in the proposal. Measurement for payment shall be based on the actual number of complete and functional, boxes and covers adjusted as shown on the Contract Drawings or as directed by the Owner or Engineer.

BASIS OF PAYMENT:

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, and inspection of adjusted box and cover on existing water valve box structure(s) complete as indicated on the 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; removal of brick, concrete, or bituminous sidewalk; excavation of bituminous concrete roadway; excavation; transporting material to/from soil staging area; protection of existing gate valve; adjusting structure; furnishing, placing and compacting suitable backfill soil; grade and compact gravel pavement sub-base; compaction testing; and all appurtenances and 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 bituminous concrete and construction debris; procurement, installation, and compaction of CDF; frames and cover for proposed valve gate boxes; adjusting valve gate boxes for paving.

END OF SECTION 02640

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SECTION 02645

HYDRANTS

2645.1	NEW 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.
- B. Section 01060 – PERMITS AND REGULATORY REQUIREMENTS
 - 1. 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 (2 ties per item from existing building corners, existing gate valves, and/or existing hydrants only) 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.

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 - SUBMITTAL:
 - 1. Submit shop drawings and manufacturers descriptive literature, showing hydrant dimensions and features.
 - 2. Submit certifications that all wetted surface metals in contact with

potable water comply with the 2014 Safe Drinking Water Act Lead Reduction law and comply with NSF 372

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 area of 39 square inches (5-inch minimum diameter circle). 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. Hydrant branches shall be fully restrained from the anchor tee to the hydrant. Every hydrant shall be

equipped with a 6-inch shut-off valve, bolted or anchored to the hydrant tee.

- G. Hydrants shall be flow tested and painted per Cambridge Water Department requirements. See 3.1.G this Section.
- H. Materials used for wetted surface metals in contact with potable water shall be lead free with lead level not exceeding 0.25%. Materials shall comply with the 2014 Safe Drinking Water Act Lead Reduction law and comply with NSF 372.

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 be provided as necessary and 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.

2.5 PAINT

- A. Hydrants shall be painted with Hammond, gloss enamel, interior and exterior, industrial maintenance coating, color "Hydrant Blue" after installation and CWD has flow tested the appurtenance.

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 to the bury shall be set 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.
- E. Hydrants shall be cleaned, finish painted to match City of Cambridge color scheme, and touched up after installation.
- F. 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.
- G. 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.
- H. 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

PART 4 – COMPENSATION

Item 2645.1 – New Hydrant

METHOD OF MEASUREMENT:

Measurement for payment for New Hydrant will be based on the actual number of new hydrants furnished and installed, as shown on the Contract Drawings or as required by the Engineer and as measured by the Engineer.

BASIS OF PAYMENT:

Payment for New 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 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; transporting material to/from soil staging area; 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;

and all incidental work required for the providing and the installation of a new hydrant not included for payment elsewhere. Hydrants located in curb extensions will only be paid for once for installation of hydrant and any costs associated with relocating hydrant to new curb line.

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 direction of the Engineer. The work includes, but is not limited to; saw cutting; excavation; furnish and install backfill; transporting material to/from soil staging area; 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; disposal of the hydrant; 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

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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 include the following:
 - 1. Section 02210 - EARTH EXCAVATION, BACKFILL, FILL AND GRADING
 - 2. Section 02630 - DUCTILE IRON PIPE AND FITTINGS
 - 3. Section 02640 – VALVES AND APPURTENANCES
 - 4. Section 02675 – DISINFECTION OF WATER MAINS
 - 5. Section 02704 – PIPELINE PRESSURE AND LEAKAGE TESTING

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 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.
 - 3. Contractor shall notify by flyer all affected water customers a minimum of 72 hours prior to any water main shutdown.

- 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.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 02647

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SECTION 02660

WATER SERVICES

2660.1 **1-IN TO 3-IN WATER** **LINEAR FOOT**
SERVICE REPLACEMENT AND RECONNECT

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 Contract Drawings or as directed by the Engineer. In general, a service shall be brought to each developed parcel of property along the water main route.
2. Provide permanent blow-offs at dead-end water mains.
3. Transfer existing services to an existing water main as shown on the Contract Drawings or as directed by the Engineer.
4. Replace services $\frac{3}{4}$ " and smaller with 1" services as shown on the Contract Drawings or as directed by the Engineer.
5. Replace all lead services as shown on the Contract Drawings or as directed by the Engineer.
6. Contractor shall coordinate with property owners and property owner's contractor for replacement of water services on private property at locations indicated within the utility plans in the Contract Documents.

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.

1.4 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 – QUALITY CONTROL.
- 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 2-inch mains shall be copper tubing, type K, drawn temper.
 - a. Type K hard-temper in sizes larger than 1-inch;
 - b. Type K soft-temper for 1-inch services.
- 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. Pipe and fittings in contact with potable water shall be lead free with lead level not exceeding 0.25%. Materials shall comply with the Safe Drinking Water Act Lead Reduction law and with NSF Standard 372.

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). Corporation stops shall be Mueller 110, Model H-15008, designed for 175 psi test pressure and manufactured by Mueller Inc. or approved equivalent. Stops to have full keyway and rigid liners.
- B. Curb stops shall be Mueller H15219 Mark II Oriseal or approved equivalent with drain suitable for use with polyethylene tubing specified hereinbefore. Stops shall have integral checks, O-ring seal and shall be furnished with rigid liners.
- 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 or approved equivalent. Bodies shall be ductile iron and straps shall be electrogalvanized carbon steel. Units shall be complete with Buna-N gaskets or approved equivalent.
- E. Pipe and fittings in contact with potable water shall be lead free with lead level not exceeding 0.25%. Materials shall comply with the Safe Drinking Water Act Lead Reduction law and with NSF Standard 372.

2.3 FITTINGS

- A. Unless otherwise approved, only compression type fittings manufactured by Mueller Inc., or approved equivalent, shall be used.
- B. Adapters required to allow connection to existing services shall be provided.
- C. Pipe and fittings in contact with potable water shall be lead free with lead level not exceeding 0.25%. Materials shall comply with the Safe Drinking Water Act Lead Reduction law and with NSF Standard 372.

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.
- C. Each service shall be flushed thoroughly and the end closed with plug or corporation stop prior to backfilling prohibiting soils or groundwater from entering the pipe.
- D. Connections to the existing services shall be thoroughly flushed, from the water main to the water meter, 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 when and where applicable.

PART 4 – COMPENSATION

Item 2660.1 – 1-in to 3-in Water Service Replacement and Reconnect

METHOD OF MEASUREMENT:

Measurement for payment for 1-in to 3-in Water Service Replacement and Reconnect will be based on the actual linear feet of pipe installed, tested, and accepted, from 1-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 1-in to 3-in Water Service Replacement and Reconnect 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 reconnect, and replace existing water services between ½-in and 3-in in diameter, which are in elevation or alignment conflict with the proposed Work, which require reconnection to replaced water mains, and which are existing ¾" or less in diameter or lead services, at all depths, complete as shown on the Contract Drawings or as required by the Engineer. This item also includes installation of end of line blow-offs at dead-end water mains. The work includes; saw cutting bituminous or cement concrete; excavation; transporting material to/from soil staging area; 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, fittings, couplings, appurtenances and joints; coordinating with property owner contractor's at locations shown within the contract documents for replacement of water services on private property; connections to existing and proposed pipes; chlorination; flushing/cleaning and testing; 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 02630 - DUCTILE IRON PIPE AND FITTINGS.
 - 2. Section 02704 - PIPELINE PRESSURE AND LEAKAGE TESTING.

1.3 SYSTEM DESCRIPTION

- A. Disinfect all water mains installed under this contract. Disinfection shall occur subsequent to the installation of the new pipe in accordance with Section 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, dechlorination of water with high concentrations of chlorine, and discharge; 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 and 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.
 5. Labor, equipment and materials required for dechlorination of chlorinated water as required for discharge.
 6. Labor and equipment to operate newly installed mainline valves, air release valves, and blowoff valves as necessary and required by the Engineer.
- D. The Contractor shall be responsible for disinfecting and putting into service new water mains that shall become the property of the Owner.
- E. All new water main segments longer than 15' shall be tested between 2 new valves per the Cambridge Water Department requirements, unless pre-approved otherwise by the Cambridge Water Department.
- F. Contractor shall be responsible for coordinating all activities with the Cambridge Water Department (CWD) when using 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 Owner 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 three (3) days prior to stated work.
 3. Notification shall include location of work, length and diameter of the pipe and other pertinent information.
 4. Contractor shall notify by flyer all affected water customers a minimum of 72 hours prior to any water main shutdown.

1.6 SUBMITTALS

- A. Contractor to submit written disinfection plan to Engineer for review. Plan to include flushing/swabbing and disinfection protocol, including but not limited to the following: management of water, chemical data, feed rates, dechlorination plan 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.
 - 2. Calcium hypochlorite intended for swimming pool disinfection shall not be used.
- 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 a DEP-certified laboratory to collect samples and perform bacteriological tests.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General:

Inman Square Intersection
Safety Improvement Project
Issued for Bid

DISINFECTION OF WATER MAINS
02675-3

1. Perform disinfection and flushing in accordance with AWWA C651.
2. The Engineer will review flushing and disinfection procedures, 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, Owner-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 up to 16-inch in diameter shall be properly flushed by the Contractor. In general, flushing shall be performed at a flow rate required to achieve a minimum velocity of 3.0 feet per second (approximately 4250 GPM in a 24-inch main, 750 GPM in a 10-inch diameter main, and 400 GPM in 8-inch diameter 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-feet 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 (residual greater than 2mg/l) shall be dechlorinated to a level of 2 PPM or less 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 a DEP-certified 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. The Cambridge Water Department will provide a special sampling apparatus that they will attach to the testing copper pipe when collecting samples. A minimum of two (2) samples shall be taken 15 minutes apart with the sample tap running, per 1,200 feet of pipe, at each end, and at branches greater than 1 pipe length, each in duplicate, in sterile bottles and sent to a State approved private laboratory for analyses. The Contractor shall be responsible for all necessary work including delivery of samples to a certified 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 Owner'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 Owner.

B. Main Activation

1. Upon receipt of satisfactory bacteria sample test results and successful pressure tests, Contractor shall notify Owner to have the Owner's 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.

PART 4 – COMPENSATION (NOT USED)

END OF SECTION 02675

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 65 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 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 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.

Dispose of test water in a manner approved by the Engineer.

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 Owner's requirements. All repairs shall be performed at no additional cost to Owner.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 02704

SECTION 02780

PRECAST CONCRETE PAVERS

2780.1	CONCRETE UNIT PAVERS	SQUARE YARDS
2780.2	PERMEABLE CONCRETE UNIT PAVERS	SQUARE YARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment necessary to complete the work of this Section and as indicated on the Drawings, but not limited to the following:
 - 1. Precast concrete unit pavers on cast-in-place concrete slab
 - 2. Permeable precast concrete unit pavers on sand-based structural soil
 - 3. Joint and Setting Bed Sand for precast concrete unit pavers on cast-in-place concrete slab
 - 4. Aggregate setting bed and joint material for permeable precast concrete unit pavers on sand-based structural soil
 - 5. Aggregate base and subbase material
 - 6. Edge Restraint

1.2 RELATED WORK

- A. Section 02604: Catch Basins
- B. Section 02810: Irrigation
- C. Section 02900: Landscaping
- D. Section 02990: Site Furnishing
- E. Section 02901: Planting Soils
- F. Section 02995: Granite Masonry for Landscape

1.3 REFERENCES

- A. All work and materials shall conform to the requirements of the Massachusetts Department of Transportation, Highway Division Standard Specifications for Highways and Bridges (MDOTSSHB), latest edition.
- B. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

American Society for Testing and Materials (ASTM):

C29 Bulk Density and Voids in Aggregate

C33 Concrete Aggregates

C136 Sieve Analysis of Fine and Coarse Aggregates

C936 Solid Concrete Interlocking Paving Units
D448 Sizes of Aggregate for Road and Bridge Construction

1.4 SUBMITTALS

A. Concrete Unit Pavers and Permeable Concrete Unit Pavers:

1. Submit samples for verifications: Three representative full-size samples of the selected paver type, thickness, color and finish that indicate the range of color variation and texture expected upon project completion.
2. Accepted samples become the standard of acceptance for the product produced.
3. Test results from an independent testing laboratory for compliance of concrete pavers with ASTM C 936.
4. Manufacturer's catalog product data and installation instructions.

B. Joint and Setting Bed Sand:

1. Provide three representative one pound samples in containers of Joint Sand materials.
2. Provide three representative one pound samples in containers of Setting Bed Sand materials.
3. Test results from an independent testing laboratory for sieve analysis per ASTM C 136 conforming to the grading requirements of ASTM C 144.

C. Base and Subbase Aggregate:

1. Test results from an independent testing laboratory for sieve analysis per ASTM C 136.

D. Joint Opening and Bedding Course Aggregate:

1. Test results from an independent testing laboratory for compliance with ASTM D 448 No. 8.
2. Test results from an independent testing laboratory for sieve analysis, including washed gradations per ASTM C 136.
3. Test results for void space percentage per ASTM C 29.

E. Joint Mortar at Vault Cover

1. Submit samples of product with full-range of available colors

F. Steel edging

1. Submit 12" sample for verification.

G. Paving Installation Contractor:

1. Submit job references from a minimum of three projects similar in size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.

1.5 QUALITY ASSURANCE

A. Utilize a Manufacturer having at least ten years of experience manufacturing interlocking concrete pavers on projects of similar nature or project size.

B. Source Limitations:

1. Obtain all pavers from one source location with the resources to provide products of consistent quality in appearance and physical properties.
2. Obtain Joint and Setting Bed Sands from one source with the resources to provide materials and products of consistent quality in appearance and physical properties.
3. Obtain Permeable Joint Opening Aggregate from one source with the resources to provide materials and products of consistent quality in appearance and physical properties.

C. Paving Contractor Qualifications:

1. Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicated on this project.
2. Utilize a Contractor conforming to all local, state/provincial licensing and bonding requirements.

D. Mockups:

1. Install a 10 ft x 10 ft paver area which includes the transition between permeable and non-permeable paver types
2. Use this area to determine joint sizes, lines, laying pattern(s), color selections, levelness, and texture of the job.
3. This area will be used as the standard by which the work will be judged.
4. Subject to acceptance by owner, mock-up may be retained as part of finished work.
5. If mock-up is not retained, remove and dispose legally.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. In accordance with Conditions of the Contract.

B. Manufacturer required to complete production of materials within 30 days after order

has been placed to avoid construction delays.

- C. Deliver Unit Pavers in manufacturer's original, unopened and undamaged container packaging with identification labels intact.
 - 1. Coordinate delivery and paving schedule to minimize interference with normal use of streets and sidewalks adjacent to paver installation.
 - 2. Deliver unit pavers to the site in steel banded, plastic banded or plastic wrapped packaging capable of transfer by forklift or clamp lift.
 - 3. Unload pavers at job site in such a manner that no damage occurs to the product or adjacent surfaces.
- D. Store and protect materials such that they are kept free from mud, dirt and other foreign materials.
- E. Prevent Joint and Setting Bed Sand from exposure to rainfall or removal by wind with secure, waterproof covering.

1.7 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Install Concrete Pavers only on unfrozen and dry Setting Bed Sand.
 - 2. Install Concrete Pavers only on unfrozen and dry Base or Subbase Aggregate materials.
 - 3. Install Base or Subbase Aggregates only over unfrozen subgrade.
 - 4. Install Setting Bed Sand or Concrete Pavers only when there is no heavy rain or snowfall.
 - 5. Do not install permeable pavers on bedding sand, unless otherwise indicated.
 - 6. Do not install permeable pavers on frozen permeable setting bed aggregate materials.
 - 7. No paving work shall be laid in temperatures below 40° Fahrenheit unless provisions are made to protect adequately the masonry materials and the finished work from frost by heating materials, enclosing the work, and heating enclosed spaces. All masonry materials used in freezing weather shall be at a temperature between 50° and 90° Fahrenheit. Protect masonry against freezing for at least 48 hours after it has been laid. No frozen work shall be built upon. Any completed work found to be affected by frost shall be taken down and rebuilt.

1.8 MAINTENANCE

- A. Provide a minimum of 5% additional material for overage to be used during construction.
- B. Contractor to provide 100 square feet of each product and size used to owner for maintenance and repair. Furnish Pavers from the same production run as installed

materials.

- C. Manufacturer to supply maintenance manuals for Concrete Pavers and Permeable Pavers.

PART 2 - PRODUCTS

2.1 CONCRETE UNIT PAVERS

A. Precast Concrete Unit Paver Type 1

1. Paver: City Park as manufactured and distributed by Unilock. Contact Daniel Neviackas, daniel.neviackas@unilock.com, 508-278-4536. Or approved equal.
2. Color: Natural
3. Finish: Premier
4. Size: 7.875" X 7.875" X 2.75". Manufacture the size indicated with a maximum tolerance of plus or minus 1/16 in all directions.

B. Precast Concrete Unit Paver Type 2

1. Paver: City Park as manufactured and distributed by Unilock. Contact Daniel Neviackas, daniel.neviackas@unilock.com, 508-278-4536. Or approved equal.
2. Color: Granite
3. Finish: Premier
4. Size: 7.875" X 7.875" X 2.75". Manufacture the size indicated with a maximum tolerance of plus or minus 1/16 in all directions.

C. Precast Concrete Unit Paver Type 3

1. Paver: City Park as manufactured and distributed by Unilock. Contact Daniel Neviackas, daniel.neviackas@unilock.com, 508-278-4536. Or approved equal.
2. Color: Winter Marvel
3. Finish: Umbriano
4. Size: 7.875" X 7.875" X 2.75". Manufacture the size indicated with a maximum tolerance of plus or minus 1/16 in all directions.

- D. Pavers must meet the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units. Efflorescence shall not be a cause for rejection.

1. Average compressive strength 8000 psi (55MPa) with no individual unit under 7,200 psi (50 MPa).
2. Average absorption of 5% with no unit greater than 7% when tested according to ASTM C 140.

3. Resistance to 50 freeze-thaw cycles, when tested according to ASTM C1645-06, with no breakage greater than 1.0% loss in dry weight of any individual unit. Conduct this test method not more than 12 months prior to delivery of units.

E. Maximum allowable breakage of product is 5%.

2.2 PERMEABLE CONCRETE UNIT PAVERS

A. Permeable Precast Concrete Unit Paver Type 1

1. Paver: City Park as manufactured and distributed by Unilock. Contact Daniel Neviackas, daniel.neviackas@unilock.com, 508-278-4536. Or approved equal.
2. Color: Natural
3. Finish: Premier
4. Size: 7.875" X 7.875" X 2.75". Manufacture the size indicated with a maximum tolerance of plus or minus 1/16 in all directions.

B. Permeable Precast Concrete Unit Paver Type 2

1. Paver: City Park as manufactured and distributed by Unilock. Contact Daniel Neviackas, daniel.neviackas@unilock.com, 508-278-4536. Or approved equal.
2. Color: Granite
3. Finish: Premier
4. Size: 7.875" X 7.875" X 2.75". Manufacture the size indicated with a maximum tolerance of plus or minus 1/16 in all directions.

C. Permeable Precast Concrete Unit Paver Type 3

1. Paver: City Park as manufactured and distributed by Unilock. Contact Daniel Neviackas, daniel.neviackas@unilock.com, 508-278-4536. Or approved equal.
2. Color: Winter Marvel
3. Finish: Umbriano
4. Size: 7.875" X 7.875" X 2.75". Manufacture the size indicated with a maximum tolerance of plus or minus 1/16 in all directions.

D. Pavers must meet the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units. Efflorescence shall not be a cause for rejection.

1. Average compressive strength 8000 psi (55MPa) with no individual unit under 7,200 psi (50 MPa).
2. Average absorption of 5% with no unit greater than 7% when tested according to ASTM C 140.

3. Resistance to 50 freeze-thaw cycles, when tested according to ASTM C1645-06, with no breakage greater than 1.0% loss in dry weight of any individual unit. Conduct this test method not more than 12 months prior to delivery of units.
- E. Accept only pigments in concrete pavers conforming to ASTM C 979. Note: ACI Report No. 212.3R provides guidance on the use of pigments.
- F. Maximum allowable breakage of product is 5%.

2.3 JOINT SAND

- A. Provide natural Joint Sand as follows:
1. Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
 2. Do not use limestone screenings, stone dust, or sand for the Joint Sand material that does not conform to the grading requirements of ASTM C 33.
 3. Utilize sands that are as hard as practically available where concrete pavers are subject to vehicular traffic.
 4. Gradation as shown in Table 1 below:

**TABLE 1 – JOINT SAND
GRADATION REQUIREMENTS FOR JOINT SAND**

ASTM C 144		
Sieve Size	Natural Sand Percent Passing	Manufactured Sand Percent Passing
No. 4 (4.75 mm)	100	100
No. 8 (2.36 mm)	95 to 100	95 to 100
No. 16 (1.18 mm)	70 to 100	70 to 100
No. 30 (0.600 mm)	40 to 75	40 to 75
No. 50 (0.300 mm)	10 to 30	20 to 40
No. 100 (0.150 mm)	2 to 15	10 to 25
No. 200 (0.075)	0 to 1	0 to 10

2.4 SETTING BED SAND

- A. Provide Setting Bed Sand as follows:
1. Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
 2. Do not use limestone screenings, stone dust, or sand material that does not conform to the grading requirements of ASTM C 33.
 3. Do not use mason sand or sand conforming to ASTM C 144.

4. Utilize sands that are as hard as practically available where concrete pavers are subject to vehicular traffic.
5. Conform to the grading requirements of ASTM C 33 with modifications as shown in Table 2 below:

**TABLE 2 – SETTING BED SAND
GRADATION REQUIREMENTS FOR SETTING BED SAND**

ASTM C 33	
Sieve Size	Percent Passing
3/8 in (9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	85 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (0.600 mm)	25 to 60
No. 50 (0.300 mm)	10 to 30
No. 100 (0.150 mm)	2 to 10
No. 200 (0.075)	0 to 1

Note: Coarser sand than that specified in Table 1 above may be used for joint sand including C 33 material as shown in Table 2. Use material where the largest sieve size easily enters the smallest joints. For example, if the smallest paver joints are 2 mm wide, use sand 2 mm and smaller in particle size. If C 33 sand is used for joint sand, extra effort may be required in sweeping material and compacting the pavers in order to completely fill the joints.

2.5 JOINT OPENING AND BEDDING COURSE AGGREGATE

- A. Provide permeable Joint Opening and Bedding Course Aggregate materials conforming to ASTM C 33 and gradation requirements of ASTM D 448 No. 8 as presented in Table 1.

**TABLE 1
JOINT OPENING AND BEDDING COURSE AGGREGATE
GRADATION REQUIREMENTS**

ASTM No. 9	
Sieve Size	Percent Passing
3/8 in	100
No. 4	85 to 100
No. 8	10 to 40
No. 16	0 to 10

No. 50	0 to 5
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2.6 PERMEABLE BASE AGGREGATE

- A. Provide Permeable Base Aggregate materials conforming to ASTM C 33 and gradation requirements of ASTM D 448 No. 57 as presented in Table 4.

**TABLE 4
PERMEABLE BASE AGGREGATE
GRADATION REQUIREMENTS**

ASTM No. 57	
Sieve Size	Percent Passing
1-1/2 in (37.5 mm)	100
1 in (25 mm)	95 to 100
1/2 in (12.5 mm)	25 to 60
No. 4 (4.75 mm)	0 to 10
No. 8 (2.36 mm)	0 to 5

2.7 PERMEABLE SUBBASE AGGREGATE

- A. Provide Permeable Subbase Aggregate materials conforming to ASTM C 33 and gradation requirements of ASTM D 448 No. 2 as presented in Table 5.

**TABLE 5
PERMEABLE SUBBASE AGGREGATE
GRADATION REQUIREMENTS**

ASTM No. 2	
Sieve Size	Percent Passing
3 in (75 mm)	100
2-1/2 in (63 mm)	90 to 100
2 in (50 mm)	35 to 70
1-1/2 in (37.5 mm)	0 to 15
3/4 (19 mm)	0 to 5

Note: For all aggregates, provide washed, clean, have zero plasticity, free from deleterious or foreign matter, crushed, angular rock and contain no No. 200 sieve size aggregate materials used in the construction of permeable pavement. Aggregate materials serve as the structural load bearing platform of the pavement as well as a temporary receptor for the infiltrated water that is collected through the openings in the pavement's surface.

2.8 JOINT MORTAR AT VAULT COVER

- A. Rompox-D2000, 2-Component epoxy resin paving jointing mortar
- B. Or approved equal

2.9 METAL EDGE RESTRAINT

- A. Metal Edge Restraints:
 - 1. Permaloc, www.permaloc.com
 - a. Material Type: Aluminum
 - b. Model No.: 3 inch GeoEdge capture plate and geogrid
 - 2. Or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION - GENERAL

- A. Examine areas indicated to receive paving for compliance with requirements for installation tolerances and other conditions affecting performance before placing the Permeable Concrete Pavers or Precast Concrete Unit Pavers.
 - 1. Verify that subgrade preparation, compacted density and elevations conform to specified requirements.
 - 2. Provide written density test results for soil subgrade and to the Owner's Representative.
 - 3. Verify location, type, and elevations of edge restraints, concrete collars around utility structures, and drainage inlets.
 - 4. Verify that concrete slab base meets elevations and specified requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Verify that the soil subgrade is free from standing water.
- B. Verify the Concrete Underlayment is clean and dry, certified by General Contractor as meeting material, installation and grade specifications.
- C. Stockpile Setting Bed Sand, Joint Sand, Permeable Setting Bed and Joint Aggregate material such that they are free from standing water, uniformly graded, free of any organic material or sediment, debris, and ready for placement.

- D. Remove any excess thickness of soil applied over the excavated soil subgrade to trap sediment from adjacent construction activities before placing the Permeable Setting Bed material.
- E. Keep area where pavement is to be constructed free from sediment during entire job. Remove and replace all Permeable Joint and Setting Bed Aggregate materials contaminated with sediment with clean materials.
- F. Complete all subdrainage of underground services within the pavement area in conjunction with subgrade preparation and before the commencement of paving installation.
- G. Do not damage underdrain pipes, overflow pipes, observation wells, or inlets and other drainage appurtenances during installation. Report all damage immediately.
- H. Compact soil subgrade as specified in Section 02910 Planting Soils.

3.3 INSTALLATION – UNIT PAVERS

A. SETTING BED SAND

1. Provide and spread Setting Bed Sand evenly over the Concrete Underlayment and screed to a nominal thickness of 1 in. (25 mm).
 - a. Protect screeded Setting Bed Sand from being disturbed by either pedestrian or vehicular traffic.
 - b. Screed only the area which can be covered by pavers in one day.
 - c. Do not use Setting Bed Sand material to fill depressions greater in the base surface.
2. Keep moisture content constant and density loose and constant until Concrete Pavers are set and compacted.
3. Screed the Setting Bed Sand using either an approved mechanical spreader (e.g.: an asphalt paver) or by the use of screed rails and boards.
4. Carefully maintain spread Setting Bed Sand in a loose condition, and protected against incidental compaction, both prior to and following screeding. Loosen any incidentally compacted sand or screeded sand left overnight before further paving units are placed.
5. Provide lightly screeded Setting Bed Sand in a loose condition to the predetermined depth, only slightly ahead of the paving units.
6. Fully protect screed Setting Bed Sand against incidental compaction, including compaction by rain. Remove any screeded Setting Bed Sand that is incidentally compacted prior to laying of the paving units. Do not permit either pedestrian or vehicular traffic on the screeded Setting Bed Sand.

7. Inspect the Setting Bed Sand course prior to commencing the placement of the Concrete Pavers. Acceptance of the Setting Bed Sand occurs with the initiation of Concrete Paver placement.

B. CONCRETE PAVERS

1. Replace Concrete Pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
2. Mix Concrete Pavers from a minimum of three (3) bundles simultaneously drawing the paver vertically rather than horizontally, as they are placed, to produce uniform blend of colors and textures. (Color variation occurs with all concrete products. This phenomenon is influenced by a variety of factors, e.g. moisture content, curing conditions, different aggregates and, most commonly, from different production runs. By installing from a minimum of three (3) bundles simultaneously, variation in color is dispersed and blended throughout the project).
3. Exercise care in handling face mix concrete pavers to prevent surfaces from contacting backs or edges of other units.
4. Provide Concrete Pavers using laying pattern as indicated. Adjust laying pattern at pavement edges such that cutting of edge pavers is minimized. Cut all pavers exposed to vehicular tires no smaller than one-third of a whole paver.
5. Use string lines or chalk lines on Setting Bed Sand to hold all pattern lines true.
6. Set surface elevation of pavers 1/8 in. (3 mm) above adjacent drainage inlets, concrete collars or channels.
7. Place units hand tight against spacer bars. Adjust horizontal placement of laid pavers to align straight.
 - a. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
8. Provide space between paver units of 1/32 in. (1 mm) wide to achieve straight bond lines.
9. Prevent joint (bond) lines from shifting more than $\pm 1/2$ in. (± 13 mm) over 50 ft. (15 m) from string lines.
10. Fill gaps between units or at edges of the paved area that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.
11. Prevent all traffic on installed Concrete Pavers until Joint Sand has been vibrated into joints. Keep skid steer and forklift equipment off newly laid Concrete Pavers that have not received initial compaction and Joint Sand material.
12. Vibrate Concrete Pavers into leveling course with a low-amplitude plate vibrator capable of a to 5000-lbf (22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:

- a. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
 - b. Compact installed Concrete Pavers to within 6 feet (2 meters) of the laying face before ending each day's work. Cover Concrete Pavers that have not been compacted and leveling course on which pavers have not been placed, with nonstaining plastic sheets to prevent Setting Bed Sand from becoming disturbed.
13. Protect face mix Concrete Paver surface from scuffing during compaction by utilizing a urethane pad.
 14. Remove any cracked or structurally damaged Concrete Pavers and replace with new units prior to installing Joint Sand material.

F. JOINT SAND

1. Provide, spread and sweep dry Joint Sand into joints immediately after vibrating pavers into Setting Bed Sand course until full. Vibrate pavers and add Joint Sand material until joints are completely filled, then remove excess material. This will require at least 4 passes with a plate compactor.
2. Leave all work to within 3 ft. (1 m) of the laying face fully compacted with sand-filled joints at the completion of each day.
3. Remove excess Joint Sand broom clean from surface when installation is complete.

3.4 INSTALLATION – PERMEABLE UNIT PAVERS

A. Edge Restraints

1. Provide metal edge restraints as indicated.
 - a. Provide plastic or metal edge restraints along the perimeter of all paving as indicated and supported on a minimum of 6 inches (150 mm) of Base Aggregate.
 - b. Provide 10" spiral galvanized or stainless steel spike to fasten edge restraint at 24 inches on center for straight sections and 12 inches on center for curved sections.
2. Provide concrete edge restraint along the perimeter of all paving as specified. Install the face of the concrete edge restraint, where it abuts pavers vertical down to the subbase.

B. Permeable Base and Subbase Aggregate

1. Provide the Permeable Subbase Aggregate in uniform lifts not exceeding 6 in., (150 mm) loose thickness and compact to at least 95 percent as per ASTM D 4254 to depths as indicated

2. Compact the Permeable Subbase Aggregate material with at least two passes in the vibratory mode then at least two in the static mode with a minimum 10 ton vibratory roller until there is no visible movement. Do not crush aggregate with the roller.
3. Tolerance: Do not exceed the specified surface grade of the compacted Permeable Subbase Aggregate material more than $\pm 3/4$ in. (20 mm) over a 10 ft. (3 m) long straightedge laid in any direction.
4. Provide the Permeable Base Aggregate material in uniform lifts not exceeding 6 in. (150 mm) over the compacted Permeable Subbase Aggregate material and compact to at least 95 percent as per ASTM D 4254 to depths as indicated.
5. Compact the Permeable Base Aggregate material with at least two passes in the vibratory mode then at least two in the static mode with a minimum 10 ton vibratory roller until there is no visible movement. Do not crush aggregate with the compaction device.
6. Tolerance: Do not exceed the specified surface grade of the compacted Permeable Base Aggregate material more than $\pm 1/2$ in. (13 mm) over a 10 ft. (3 m) long straightedge laid in any direction.
7. Grade and compact the upper surface of the Permeable Base Aggregate material sufficiently to prevent infiltration of the Permeable Setting Bed Aggregate material both during construction and throughout its service life.

C. Permeable Setting Bed Aggregate

1. Provide and spread Permeable Setting Bed aggregate evenly over the base course and screed to a nominal thickness of 2 in.
 - a. Do not disturb Sand Based Structural Soil.
 - b. Do not substantially exceed screed area which cannot be covered by pavers in one day.
 - c. Do not use Permeable Setting Bed Aggregate material to fill depressions in the base surface.
2. Keep moisture content constant and density loose and constant until pavers are set and compacted.
3. Inspect the Permeable Setting Bed Aggregate course prior to commencing the placement of the permeable concrete pavers.

D. Permeable Pavers

1. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
2. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
3. Exercise care in handling face mix pavers to prevent surfaces from contacting backs or edges of other units.
4. Provide Permeable Pavers using joint pattern as indicated. Adjust joint pattern at pavement edges such that cutting of edge pavers is minimized. Cut all pavers exposed to vehicular tires no smaller than one-third of a whole paver.
5. Place units hand tight against spacer bars. Adjust horizontal placement of laid pavers to align straight.
 - a. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
6. Provide space between paver units of 1/32 in. (1 mm) wide to achieve straight bond lines.
7. Do not exceed joint (bond) lines more than $\pm 1/2$ in. (± 15 mm) over 50 ft. (15 m) from string lines.
8. Fill gaps between units or at edges of the paved area that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.
9. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
10. Do not allow traffic on installed pavers until Permeable Joint Aggregate has been vibrated into joints. Keep skid steer and forklift equipment off newly laid pavers that have not received initial compaction and Permeable Joint Aggregate material.
11. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a to 5000-lbf (22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:
 - a. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.

- b. Compact installed concrete pavers to within 6 feet (1,800 mm) of the laying face before ending each day's work. Cover pavers that have not been compacted and leveling course on which pavers have not been placed, with non-staining plastic sheets to prevent Permeable Setting Bed Aggregate from becoming disturbed.
- 12. Remove any cracked or damaged pavers and replace with new units prior to installing Permeable Joint Opening Aggregate material.
 - 13. Provide, spread and sweep Permeable Joint Opening Aggregate into joints immediately after vibrating pavers into Permeable Setting Bed course until full. Vibrate pavers and add Permeable Joint Aggregate material until joints are completely filled, then remove excess material. This will require at least 4 passes with a plate compactor.
 - 14. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage). Do not exceed 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.
 - 15. Remove excess Permeable Joint Aggregate broom clean from surface when installation is complete.

3.5 FIELD QUALITY CONTROL

- A. Verify final elevations for conformance to the drawings after sweeping the surface clean.
 - 1. Do not deviate final surface tolerance from grade elevations more than $\pm 3/8$ in. (± 10 mm) under a 10 ft. (3 m) straightedge or indicated slope, for finished surface of paving.
- B. Set surface elevation of pavers 1/8 in. (3 mm) above adjacent drainage inlets, concrete collars or channels.
- C. Lippage: No greater than 1/8 in. (3 mm) difference in height between Permeable Interlocking Concrete Pavers and adjacent paved surfaces.

3.6 PREPARING AND CLEANING

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

- B. Cleaning: Remove excess dirt, debris, stains, grit, etc. from exposed paver surfaces; wash and scrub clean. Clean Permeable Pavers in accordance with the manufacturer's written recommendations.

3.7 PROTECTION

- A. Protect completed work from damage due to subsequent construction activity on the site.

3.8 PERMEABLE JOINT AGGREGATE MATERIAL REFILLING

- A. Provide additional Permeable Joint Aggregate material after 120 days and before 150 days after date of Substantial Completion/Provisional Acceptance.
 - 1. Fill Permeable Joint Aggregate material full to the lip of the paver.

PART 4 - COMPENSATION

2780.1 CONCRETE UNIT PAVERS SQUARE YARDS

METHOD OF MEASUREMENT:

Measurement for Concrete Unit Pavers on Cast-in-Place Concrete Slab shall be based on the square yard installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Concrete Unit Pavers on Cast-in-Place Concrete Slab shall be based on the square yard of concrete pavers on cast-in-place concrete slab as detailed in the Contract Documents installed complete for this item in the proposal. Under the square yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of concrete pavers on cast-in-place concrete slab as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to: installation of precast concrete unit pavers, setting bed sand, joint sand; excavation to depth shown in the drawings vertically of proposed grade; labor, equipment, materials, safe transportation including loading at storage site and unloading at site of installation; and all incidental work not included for payment elsewhere.

EXCLUSIONS:

The following items are not included for payment under this item: cast-in-place concrete slab, to be included for payment elsewhere.

2780.2 PERMEABLE CONCRETE UNIT PAVERS SQUARE YARDS

METHOD OF MEASUREMENT:

Measurement for Permeable Concrete Unit Pavers on Sand-Based Structural Soil shall be based on the square yard installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Permeable Concrete Unit Pavers on Sand-Based Structural Soil shall be based on the square yard of permeable concrete pavers on sand-based structural soil as detailed in the Contract Documents installed complete for this item in the proposal. Under the square yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of concrete pavers on sand-based structural soil as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to: installation of permeable precast concrete unit pavers, permeable setting bed aggregate, permeable joint aggregate, permeable base and subbase aggregate, edge restraint; excavation to depth shown in the drawings vertically of proposed grade; labor, equipment, materials, safe transportation including loading at storage site and unloading at site of installation; and all incidental work not included for payment elsewhere.

EXCLUSIONS:

The following items are not included for payment under this item: installation of aeration piping, triaxial geogrid fabric, sand-based structural soil, to be included for payment elsewhere.

END OF SECTION

SECTION 02810

IRRIGATION SYSTEM

2810.1

IRRIGATION SYSTEM

LUMP SUM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section specifies the following: labor, materials, equipment and services required to complete the irrigation work indicated on the drawings, as specified herein, or both.
- B. Mechanical point of connection for the irrigation system shall be a new 1-inch tap of the domestic water supply provided and installed at the street (see civil plans) and brought to the water supply enclosure and into a landscaped bed from the water supply enclosure using 1-inch Type K copper pipe. This work shall be compensated under Item 2660.1.
- C. Electrical point of connection for the irrigation system shall be one (1) 120-volt, 20-amp electrical circuit (see electrical plans).
- D. Drawings and specifications must be interpreted and are intended to complement each other. Furnish and install parts, which may be required by the drawings and omitted by the specifications, or vice versa, just as though required by both. Should there appear to be discrepancies or question of intent, the matter shall be referred to the Engineer for decision and his interpretation shall be final, conclusive and binding.
- E. Changes to the drawings to avoid any obstacles shall be made with the approval of the Engineer.
- F. Trench excavation, backfilling and bedding materials, together with the testing of the completed installation shall be included in this work.
- G. Work shall be constructed and finished in every respect in a good, workmanlike and substantial manner, to the full intent and meaning of the drawings and specifications. Parts necessary for the proper and complete execution of the work, whether the same may have been specifically mentioned or not, or indicated on the drawings, shall be done or furnished in a manner corresponding with the rest of the work as if the same were specifically herein described.
- H. Record Drawing as well as Operating & Maintenance Manual generation, in accordance to these specifications shall be included in this work.

1.2 SCOPE

- A. The irrigation system shown on the drawings and described within these specifications represents a single controller, landscape irrigation system supplied from municipal water. The system is designed for 12 gallons per minute. Minimum 65-psi dynamic pressure at full system flow is required from the point of connection.

1.3 RELATED WORK

- A. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- B. Section 02780 – PRECAST CONCRETE PAVERS
- C. Section 02900 – LANDSCAPING
- D. Section 02901 – PLANTING SOILS
- E. Division 16 - ELECTRICAL

1.4 ORDINANCES, PERMITS AND FEES

- A. Work under this Section shall comply with ordinances and regulations of authorities having jurisdiction.
- B. Contractor shall obtain and pay for permits, tests and certifications required for the execution of Work under this Section, as well as any services and charges by utility companies.
- C. Contractor shall furnish copies of Permits, Certifications and Approval Notices to the Engineer prior to requesting payment.

1.5 QUALITY ASSURANCE

- A. 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.
- B. References: Contractor must supply five (5) references for work of this type and size including names and phone numbers of contact person(s).
- C. 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 Pipe Systems.
 - f. ASTM: B43-98 Brass pipe.
 - g. ASTM: B88-99 Seamless Copper Water Tube
 - h. ASTM: B828-00 Soldered Copper Joints.
 - i. ASTM: D2737-99 Polyethylene (PE) Pressure rated tube.
2. National Standard Plumbing Code (NSPC)
 3. National Electric Code (NEC)
 4. National Sanitary Foundation (NSF)
 5. American Society of Irrigation Consultants (ASIC)
 6. Underwriters Laboratories, Inc. (UL)
 7. Occupational Safety and Health Administration (OSHA)

1.6 TESTS

- A. Observation: Engineer will be on site at various times to insure the system is being installed according to the specifications and drawings.
- B. Coverage Test: After completion of the system, the Contractor shall test the operation of entire system. Demonstrate to the Engineer that 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.
- C. Engineer shall be notified 7 days in advance for observations.

1.7 SHOP DRAWINGS

A. Contractor shall provide copies of product specification sheets on proposed equipment to be installed to the Engineer for approval prior to the start of work. Work on the irrigation system may not commence until product sheets are submitted and approved. Submittals shall be marked-up to indicate features/capacities/sizes/etc. as they apply to this project. Equipment to be included:

1. Drip Tubing and Accessories
2. Sprinklers and Nozzles
3. Decoders
4. Moisture Sensors
5. Lightning Arrestors
6. Valves: Manual and Automatic
7. Controller
8. Controller Enclosure
9. Valve Boxes
10. Copper Pipe and Fittings
11. PVC Pipe and Fittings
12. Polyethylene Pipe and Fittings
13. Wire and Connectors
14. Quick Coupling Valves
15. Rain Sensor w/ Sensor Guard
16. ID Tags
17. Backflow Prevention Device
18. Water Meter
19. Water Supply Enclosure
20. Flush Valves
21. Grounding Equipment
22. Aeration Pipe

23. Filter Fabric
24. Vent Grates
25. Miscellaneous Materials

B. Project Record Documents:

1. Provide and keep up-to-date a complete redlined record set of drawings of the system as the project proceeds. Drawings shall be corrected daily, showing every change from the original drawing and specifications. Each valve box location to be referenced by distance from a minimum of two permanent locations. Controller, water supply enclosure, electric valves, isolation valves, soil moisture sensors, flushing valves, quick coupling valves, and other equipment shall be indicated on the drawings. Wire routing, wire size and splices shall be indicated. Mainline, lateral pipe, drip tubing and communication cable route shall have four (4) distinctly different graphic symbols (line types). This redlined record set of drawings shall be kept at job site and shall be used only as a record set.
2. Make neat and legible notations on this record set of drawings daily as the Work proceeds, showing the Work as actually installed. For example, should a piece of equipment be installed in a location that does not match the plan, indicate that equipment in a graphic manner in the location of installation and so as to match the original symbols as indicated in the irrigation legend. Should the equipment be different from that specified, indicate with a new graphic symbol both on the drawings and the irrigation legend. The relocated equipment dimensions and northing and easting coordinates should then be transferred to the appropriate drawing in this record set of drawings at the proper time.
3. On or before the date of final field observation, deliver corrected, new completed AutoCAD computer plots of "record drawing" and AutoCAD electronic files on disk to Owner's Representative as part of contract closeout. Delivery of plots will not relieve the responsibility of furnishing required information that may have been omitted from the prints. Record drawing shall have Contractor's own title block and include as installed information only. The record drawing shall not be a marked-up version of the design plan.

C. At the end of the project the Contractor shall submit the following to the Engineer:

Two (2) quick coupling keys

1.8 DELIVERY, STORAGE AND HANDLING

- A. Store and handle materials in compliance with manufacturer instructions and recommendations. Protect from damage. Minimize on-site storage.

1.9 GUARANTEE

- A. Obtain in the City of Cambridge's name the standard written manufacturer's guarantee of materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. These guarantees shall be in addition to, and not in lieu of, other liabilities that the Contractor may have by law.
- B. In addition to the manufacturers' guarantees the entire irrigation system shall be warranted, both parts and labor for a period of one (1) year from the date of acceptance by the City of Cambridge.
- C. As part of the one-year warranty, the Contractor shall perform the first year-end winterization and spring start-up for the irrigation system shall be performed.
- D. 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 of Cambridge.
- E. A written warranty showing date of completion and period of warranty shall be supplied upon completion of the project.

1.10 COORDINATION

- A. Contractor shall coordinate his work closely with the Engineer to avoid misunderstandings and to efficiently bring the project to completion. Engineer shall be notified as to the start of work, progression and completion, as well as any changes to the drawings before the change is made. Contractor shall also coordinate his work with that of subcontractors.

1.11 MAINTENANCE AND OPERATING INSTRUCTIONS

- A. Work shall include an allowance for four (4) hours of instruction of City of Cambridge's personnel upon completion of check/test/start-up/adjust operations by a competent operator (Engineer shall be notified at least one (1) week in advance of check/test/start-up/adjust operations).
- B. 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 THE INMAN SQUARE IRRIGATION SYSTEM, shall be submitted to the Engineer. After review and approval, the copies will be forwarded to the City of Cambridge. 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 plan;
 - b. One (1) copy of the Record Drawing;
 - c. One (1) reproducible of the Record Drawing;
 - d. One (1) copy of the controller valve system wiring diagram
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 irrigation equipment;
 - b. Operation: User's Manuals
 - 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.
 6. Winterization and spring start-up procedures.
 7. Guarantee data.

1.12 PROCEDURE

- A. Notify City of Cambridge 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.
- B. Provide and install temporary support, adequate protection and maintenance of 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 the Engineer

PART 2 - PRODUCTS

2.1 GENERAL

- A. 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 system. Material overages at the completion of the installation are the property of the company performing the work and shall be removed from the site.
- B. 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.

2.2 PVC IRRIGATION PIPE

- A. Pipe shall bear the following markings: Manufacturer's name, nominal pipe size, schedule or class, pressure rating in psi, and date of extrusion.
- B. Mainline pipe shall be PVC, Class 200, Type 1120, SDR 21, Solvent-Weld PVC, conforming to ASTM No. D2241 as manufactured by IpeX, JM Eagle, Silverline or equal.

2.3 COPPER PIPE AND FITTINGS

- A. Copper pipe shall be Type K, hard tempered ASTM B88.
- B. Copper fitting shall be wrought copper, solder joint type in accordance with ASTM B828-00.
- C. Joints shall be soldered with silver solder ASTM B32, Grade 95TA up to 250 degree using non-corrosive flux.
- D. 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.

2.4 PVC PIPE SLEEVES

- A. Pipe sleeves beneath non-soil areas shall be PVC, ASTM D1784, Class 160 water pipe as manufactured by National, IpeX or JM Eagle. Minimum sleeve size to be 3-inch.

2.5 WIRE CONDUIT

- A. Conduit for wiring beneath non-soil areas shall be PVC, SCH-40 conduit with solvent-weld joints, as manufactured by Carlon, Cresline, JMM or equal.
- B. 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.

2.6 PVC IRRIGATION FITTINGS

- A. Fittings for solvent weld PVC pipe shall be Schedule 40 solvent weld PVC fittings as manufactured by Dura, Lasco, Spears or equal.
- B. Fittings shall bear manufacturer's name or trademark, material designation, size, and applicable I.P.S. schedule.
- C. 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.
- D. 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 medium set not fast (no wet and dry, or hot) 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, Oatey Primer for PVC and CPVC, or equal. No clear primers or cements shall be allowed.
- E. Nipples to be schedule 80 PVC.

2.7 POLYETHYLENE IRRIGATION PIPE

- A. Lateral pipe shall be installed with polyethylene (PE3408) pipe, SDR 15, NSF-pw, Class 100, Type III, Grade 3, Class C conforming to ASTM D2239, with a minimum pressure rating of 100 psi as manufactured by Oil Creek or equal.

2.8 POLYETHYLENE IRRIGATION FITTINGS

- A. Fittings for polyethylene pipe shall be insert PVC or Nylon type fittings. Fittings shall conform to NSF standards and be attached with two (2) offset, dog-eared stainless steel clamps. Clamps shall be as manufactured by Oetiker or approved equal.
- B. 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 Spears.

2.9 SPRAY SPRINKLERS

- A. 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. Nozzles shall be fixed arc. Variable arc nozzles shall be used only where a fixed arc nozzle is not available. Pop-up height shall be 12 inches.

- B. Sprinkler shall carry a minimum 3-year exchange warranty against defects. Sprinklers shall be manufactured by Hunter Industries model PROS-12-PRS30-CV, Rain Bird model 1812-SAM-PRS or approved equal.

2.10 ELECTRIC CONTROL VALVES

- A. 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 0.25gpm.
- B. Valves shall be manufactured by Rain Bird model PEB, Hunter Industries model ICV or equal.

2.11 VALVE BOXES (PLASTIC)

- A. Valve boxes shall be manufactured from unformed resin with a tensile strength of 3,100-5,500 psi conforming to ASTM D638. Boxes shall be green in color. Covers shall be green in color unless otherwise specified.
- B. Valve boxes for isolation valves, single electric valves, wire splices and quick coupling valves shall be 10-inch round valve boxes with metal detection, T-top lids and bolt down covers. Splice boxes shall have gray lids.
- C. Valve boxes for dual 1-inch electric valves shall be 12-inch standard valve boxes with metal detection, T-top lids and bolt down covers. When multiple 1-inch valves are installed in the same area, they are to be installed two (2) valves per box in a 12-inch standard box.
- D. Valve boxes for single and dual 1-inch drip valve assemblies shall be 18-inch jumbo valve boxes with metal detection, T-top lids and bolt down covers. When multiple 1-inch drip valves assemblies are installed in the same area, they are to be installed no more than two (2) valves per box in an 18-inch standard box.
- E. Valve box extensions shall be provided and installed as required for proper box depth. Valve box extensions shall be made by the same manufacturer as the box.
- F. Valve boxes for flushing valves on drip zones shall be 6-inch round valve boxes with metal detection, T-top lid and green cover.
- G. Valve boxes shall be manufactured by Highline Products, Carson Specification Grade, NDS Pro Series or approved equal.

2.12 VALVE BOXES (POLYMER CONCRETE)

- A. Valve boxes shall be manufactured from polymer concrete capable of withstanding a static load of greater than 45,769 pounds, meeting ASTM C857-95 with a compressive strength of 11,000 psi. Valve boxes shall be AASHTO H-20 design load.
- B. Drip zone valves shall be installed in 24-inch-wide x 36-inch long x 12-inch-deep valve box with steel checker galvanized locking cover, Model B2436-52JHG galvanized as manufactured by Oldcastle – Christy Concrete or approved equal.
- C. Valve box extensions shall be provided as required to set at proper grade.

2.13 AUTOMATIC CONTROLLER

- A. Controller shall be manufactured by Baseline Systems, model BL3200X, installed per manufacturer’s specifications, and as specified herein.
 - 1. Controller shall be able to operate:
 - a. Up to 50 zones along a two-wire path.
 - b. Up to 10 moisture sensors.
 - c. 10 separate programs.
 - d. Support one POC (flow meter, master valve, pump start)
 - e. Direct wire to internet through Ethernet port and use “Live View” to manage your controller anywhere.
 - f. Concurrently operate up to 15 AC solenoids along two wire path or 100 DC latching solenoids.’
 - g. Support 110 devices on two the wire path.
 - h. Support two-way communications with two-wire decoders.
 - i. 8 start times per program.
 - j. Support up to seven separately normally open or normally closed pause or event devices.
 - k. Execute a high flow or low flow shutdown based on total system flow or on flow per flow meter.
 - l. Detects and repairs address conflicts for devices that are connected to the two-wire path from the controller.
- B. Controller shall be capable of storing irrigation schedules, monitoring and managing flow without a Central Computer (i.e. if the Central Computer is turned off, removed, or if communication from/to the Central Computer fails, the field controller will continue to perform moisture and flow management functions). The controller shall display on-screen instructions making it easier for a user to operate the controller.
 - 1. Programmable features include:
 - a. 8 start times per program in 10-minute increments
 - b. Run time for zones from 1 second to 18 hours in one second increments
 - c. Day intervals in even, odd, or odd days excluding the 31st
 - d. Create a custom 7-day calendar, and historical calendar with customizable half months

- e. Program unique cycle soak times for each program. Soak times can be programmed between 0 minutes and 18 hours.
 - f. Specify hours during each day of the week when, or when not, water can be applied in one-hour increments in a 24-hour period.
 - g. Assign start, stop and pause irrigation modes to each program, including time based, event based and soil moisture sensor-based behaviors.
 - h. Manually enter a design flow for each zone with or without an installed flow meter.
 - i. Automatically calibrate soil moisture thresholds and make irrigation decisions based on those thresholds.
 - j. Adjust seasonal water budget from 10% to 200% by program.
 - k. Schedule up to 8 future event dates when watering will not occur.
 - l. Manually operate one zone, or all zones of a program, with programmable runtimes, delay before starting first zone, and time between zones.
 - m. Search and define devices connected to the two-wire and list them according to device type and serial number.
 - n. Back up programming and historical data with a USB flash drive
 - o. Establish three levels of local and remote PIN protection: status and stop, manual runs and full programming access.
 - p. Configure pipe stabilization time for flow management.
- C. Controller shall be able to send alerts to Live View or central software at an offsite location utilizing supported devices. Alerts shall be processed at both the field controller location and/or the Central Computer location (requires communication module). Ethernet is built in for Live View but can be used for central control with software. Communication options for central control shall be as follows:
- 1. Cellular modem
 - 2. Wi-Fi
 - 3. Ethernet Radio
 - 4. Long Haul Ethernet Wired Communication
- D. Controller shall be able to provide real time soil moisture measurements and watering feedback to the user. It includes integrated tools and software that self- diagnose problems and generate alerts and messages, and then displays the messages on the screen and remotely. It displays on screen total runtime and water used for the last two days, actual or estimated flow values, 7-day scalable soil moisture graph with 12 reading per day. It displays all pause and stop conditions in message screens. One message will be displayed for each condition and each message can be individually removed. It further displays high flow alerts, low flow alerts, pause messages and conditions, rain delays, wire faults and other operating conditions.
- E. Controller equipped with 10 levels of surge protection, 5 levels built into the controller boards with a minimum surge response time of 1 picosecond.

2.14 DECODERS

- A. Decoders shall be installed between the controller and the new electric control valves to provide the 24-volt power supply for individual valves. Each decoder shall be available in 1, 2 or 4-station devices. Decoder shall have a unique serial number and controller-assigned address to identify it in the network.
- B. Decoder shall be manufactured by Baseline or equal.

2.15 SOIL MOISTURE SENSORS

- A. Soil moisture sensors shall provide the following:
 - 1. Measures soil moisture using patented modified TDT technology.
 - 2. Sensor is self-calibrating for soil type and conditions.
 - 3. Moisture range measurement from 5% moisture to fully saturated soil (45%).
 - 4. Measures soil temperature.
 - 5. Moisture readings are consistent in salty conditions.
- B. Sensor shall be completely sealed and shall be resistant to power surges, shock, freezing, heat, salts and fertilizers.
- C. Sensor shall have the following accuracy and repeatability:
 - 1. Range: 5% to 45% volumetric (fully saturated)
 - 2. Raw Sensor Resolution: 0.01% volumetric
 - 3. Volumetric Moisture Accuracy: +/- 0.1%
 - 4. Volumetric Calibration: +/- 2% of calibrated sample
 - 5. Soil Temperature: +/- 2C/3.6F
- D. Sensor shall be 24 to 28 VAC.
- E. Sensor shall be manufactured by Baseline Systems or equal.

2.16 WIRE

- A. Valve control wire from the decoder to the valve shall be minimum #14-awg, single strand, solid copper; UL-approved direct burial AWG-U.F. 600V and shall meet state and local codes for this service.
- B. In ground wire connections shall be UL listed (486D), manufactured by Paige, 3M, model DBR/Y-6 splice kits or equal. Wire splices shall be made in valve boxes, electrical junction boxes, at the controller or at valves. Connections shall be installed as per their manufacturers' instructions.
- C. Valve control wire from the controller to the decoder shall be through two-wire. Wiring shall be double-jacketed, UL two-conductor solid copper designed for direct

burial systems. Wire shall be manufactured by Paige Electric (Maxi wire) P7072D or equal. Wire gauge shall be AWG #14/14.

- D. 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.
- E. Wiring shall be in strict accordance with national, state and local electrical codes.

2.17 SURGE ARRESTERS

- A. Surge arresters shall be installed on two-wire communication path where indicated on the drawings and as per manufacturers requirements. The unit shall have low clamping level and high current handling capabilities for protection of sensitive electronic devices. Surge arrestor shall be manufactured by Baseline Systems or equal.

2.18 WIRELESS RAIN SENSOR

- A. Sensor shall be polycarbonate in construction with adjustable interruption point and metal extension arm. Wireless rain sensor shall operate up to 200 feet from receiver unit and have built-in bypass switch on receiver panel.
- B. System operating frequency shall be 433MHz. Package shall be UL listed, FCC approved.
- C. Receiver input power shall be 24 VAC from controllers.
- D. Rain sensor package shall carry a five (5) year warranty.
- E. Rain sensor shall be manufactured by Hunter Industries, Rain Bird, Toro or approved equal.

2.19 QUICK COUPLING VALVES

- A. 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 conditions when the key is not inserted.
- B. 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.
- C. 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.
- D. Keys shall be ACME with 1-inch male thread and 3/4-inch female thread at the top.
- E. Provide one (1) key for quick coupler and one (1) 1-inch x 3/4-inch swivel hose ends.

- F. Quick coupling valves, keys and swivels shall be manufactured by Hunter Industries, model HQ-44RC-AW, HK-44A and HS-1 or approved equal.

2.20 ISOLATION VALVES

- A. Valves 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 Apollo, model 102T, Nibco, model T-113-K, or approved equal.

2.21 DEEP DRIP STAKE ASSEMBLIES

- A. Deep drip stake shall be 24-inch, constructed of PVC material. Tube shall have an outside diameter of 1¼ inches. Cap material shall be made of ABS and the combination of stake tube and cap shall be able to withstand multiple strikes from a 3-lb. sledge hammer for the purpose of installing.
- B. Deep drip stakes shall incorporate a screen filter within the unit to eliminate debris from entering the internal area of the stake. Deep drip stakes shall be designed so as to permit twisting of stakes after installation to dislodge root intrusion.
- C. Stake cap shall have an opening to accommodate 1/8-inch to ¼-inch diameter drip or low volume distribution tubing. The internal stake tube dimensions shall be able to house a fixed or variable low volume emitter.
- D. ¼ inch diameter drip distribution tubing shall be black EDTUBE as manufactured by Netafim. Fittings shall be UV resistant and be 0.160-inch fittings compatible with solid drip tubing and distribution tubing.
- E. Stakes shall have a 2 gph emitter installed in the stake. Emitter shall be as manufactured by Rain Bird, model XB-20PC (Red).
- F. Drip stake assemblies shall be manufactured by Green King, model ADD24 as indicated on the drawings.

2.22 INLINE AND BLANK DRIP TUBING

- A. Inline drip tubing to be 17 mm with 0.60 gallon per hour emitters with integral check valve on pre-installed 12-inch spacing within tube for planting beds and drip rings. In-line drip tubing to be as manufactured by Netafim Irrigation, Model TLCV-6-12 or approved equal. Start pressure shall be a minimum of 45 psi.
- B. Blank drip tubing for tree rings shall be solid 17mm low density polyethylene resin, UV resistant as manufactured by Netafim Irrigation, Model TLD-L0XX.

2.23 IN-LINE AND BLANK DRIP TUBING FITTINGS

- A. Fittings for in-line and blank 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.
- B. 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.
- C. Tubing stakes shall be plastic coated steel, or non-corrosive material to secure tubing.

2.24 DISC FILTER

- A. 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.
- B. Filter shall be as manufactured by Netafim, Model DF-xxx-140 or approved equal.

2.25 MANUAL FLUSHING VALVE

- A. Manual valve used for flushing drip irrigation zones shall be ½ inch ball valves of bronze construction, US Manufacture, minimum 3/4 port, 600 WOG with stainless steel handle and chrome plated ball. Ball valves to be as manufactured by Apollo, Boston or Watts. or approved equal.

2.26 PRESSURE REGULATORS

- A. 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.
- B. Pressure regulator shall be as manufactured by Netafim, Model PRV-XXX-XX-45 or approved equal.

2.27 PERFORATED AERATION/DISTRIBUTION PIPE

- A. Pipe used for soil aeration and irrigation distribution under hardscaped areas shall be made of high-density polyethylene (HDPE). Pipe shall be corrugated, perforated and single wall.

- B. Aeration/distribution pipes shall be installed in a protective sock manufactured of 100% knitted polyester.
- C. Pipe joints shall be soil tight and utilize snap couplers.
- D. Pipe shall conform to specifications AASHTO M-252, AASHTO M-292, ASTM F404 and ASTM F606.
- E. Pipe shall be manufacture by ADS or approved equal.

2.28 DRAINAGE/VENT GRATE

- A. Valve/assess boxes for aeration/irrigation service and venting shall be 9-inch square catch basins with cast iron grated covers. Catch basin shall be manufactured of structural-foam polyolefin with UV inhibitor, black in color. Catch basin shall be provided with universal outlet adapter to securely connect 4-inch corrugated and perforated aeration pipe to catch basin. Catch basin shall be manufactured by Old Castle, NDS, Carson or equal.
- B. Catch basin cover shall be 9"x9" square, heavy duty cast iron with black powder coating. Cover shall be ADA compliant and heel proof, have a minimum load rating of H-20 and be able to be securely fastened to the catch basin by means of stainless-steel screws. Total open area of the grate shall be a minimum of 20 square inches. Grate shall integrate with typical 9-inch square polyethylene catch basin by NDS or Old Castle. Catch basin cover shall be manufactured by Nashua Foundries, Nashua, NH or equal.

2.29 IRRIGATION DISPENSING STRIP

- A. Filter fabric shall be provided under all subsurface aeration pipes that contain irrigation drip tubing for the purpose of water dispersion. Filter fabric shall be a woven, calendared, monofilament filtration geotextile made of 100% polypropylene yarns.
- B. Filter fabric shall have a percent open area of 4% to 6% and shall satisfy the requirements as outlined in AASHTO M-288-06 for permanent erosion control and subsurface drainage class 2 and 3. Filter fabric shall have minimum puncture strength of 120 lbs. per ASTM D-4833. Filter fabric shall be as manufactured by US Fabrics, model US 670 or approved equal.

2.30 SWING JOINTS

- A. ½-inch sprinklers shall be installed on swing pipe assemblies, minimum length 6 inches, maximum 18 inches as manufactured by Hunter, Irritrol or Rain Bird.
- B. 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). Prefabricated PVC swing joints shall be as manufactured by Dura, Lasco or Spears.

2.31 IDENTIFICATION TAGS

- A. Valves shall have ID tags attached. ID tags shall be manufactured from Polyurethane Behr Desopan. Provide one tag for each electric valve. Use one maxi size tag for electric control valve. Each tag shall provide valve and decoder ID information.
- B. Tags shall be as manufactured by T. Christy Enterprises or Paige Electric.

2.32 INDICATOR STAKES

- A. Each drip zone shall include an indicator stake located where directed by the Owner's Representative.
- B. Indicator stake shall raise flag to full upright position to indicate system operation at a minimum of 10 psi operating pressure. Indicator stake shall be preassembled with indicator flag, anchoring stake, tubing and barb connector.
- C. Indicator stake shall be as manufactured by Netafim, Model 10-F-01 or equal.

2.33 GROUNDING EQUIPMENT

- A. Grounding rod for surge arrestor decoder to be 5/8-inch x 8-foot copper clad, UL Listed.
- B. Grounding rod for controller to be 5/8-inch x 10-foot copper clad, UL Listed.
- C. Grounding plate for surge arrestor decoder to be 4-inch x 36-inch x 0.06-inch copper with integral connection of 10 feet of #10 AWG insulated, solid copper wire, UL Listed conforming to the minimum requirements of Section 250 of the National Electric Code. Connection of the wire to plate shall be performed by the plate manufacturer.
- D. Grounding plate for controller to be 4-inch x 96-inch x 0.06-inch copper with integral connection of 10 feet of #6 AWG insulated, solid copper wire, UL Listed conforming to the minimum requirements of Section 250 of the National Electric Code. Connection of the wire to plate shall be performed by the plate manufacturer.
- E. Grounding connections to utilize an exothermic welding process, Cadweld connectors, UL Listed, Model NT1161GPLUS.
- F. Grounding wire for surge arrestors shall be #10 AWG, solid, bare copper wire for surge arrestor decoders.
- G. Grounding wire for controller shall be #6 AWG, solid, bare copper wire for surge arrestor decoders.

- H. Ground enhancement material shall be PowerSet as manufactured by Loresco, 50 lb. bags.

2.34 WATER METER

- A. Water meter shall be 1-inch Neptune T-10 meter or equal as approved by the Cambridge Water Department with approved remote read.

2.35 BACKFLOW PREVENTION DEVICE

- A. Backflow prevention device shall be 1-inch Reduced Pressure Assembly as per City of Cambridge Cross Connection Department requirements. Backflow prevention device shall be as manufactured by Watts, model LF-009-QT-S or approved equal, maximum 12-psi pressure loss at full system flow.

2.36 CONCRETE BASES

- A. Concrete controller and water supply enclosure bases shall be standard concrete mix in accordance with ASTM C150, ASTM C-33, and ASTM C-94 with a compressive strength (28 days) of 3,000 psi.
- B. Concrete base enclosure dimensions shall be as indicated on the details.
- C. Bases shall be installed on minimum 6-inch crushed stone.

2.37 WATER SUPPLY ENCLOSURE

- A. Backflow prevention device/meter enclosure shall be of a vandal and weather resistant nature manufactured entirely of marine grade aluminum alloy 5052-H32, with a wall thickness of one-eighth inch. Box color shall be forest green, 6 mils thick epoxy.
- B. Enclosure shall anchor to the concrete and have a front side access panel for equipment servicing.
- C. Enclosure shall be 38 inches high, 16 inches wide and 30 inches long with a 2-inch internal base lip for anchoring with 3/4-inch x 2-3/4 inches long 304 stainless steel wedge anchors. Unit shall be as manufactured by Welch Manufacturing, Chelmsford, Mass or equal.

2.38 CRUSHED STONE

- A. Crushed stone shall be in conformance with MassDOT Standard Specifications M2.01.1. Crushed stone shall be used under valve boxes.

2.39 SAND

- A. 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.

2.40 SPARE PARTS

- A. Supply the following tools and equipment to the Engineer before final observation:
 - 1. Two (2) quick coupling keys

PART 3 - EXECUTION

3.1 GENERAL

- A. Before work is commenced, hold a conference with the Engineer to discuss general details of the work.
- B. Examine contract documents applying to this Section noting any discrepancies and bringing the same to the attention of the Engineer for timely resolution.
- C. Work indicated on drawings shall be provided whether or not specifically mentioned in the specifications.
- D. 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. Such obstructions, conflicts, or discrepancies shall be brought to the attention of the Engineer.
- E. Make field measurements necessary for the work noting the relationship of the irrigation work to the other trades. Coordinate with other trades (landscaping and other 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.
- F. Coordinate installation of materials, including pipe, to avoid conflict with the trees, shrubs, or other plantings.
- G. 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.
- H. Replace, or repair to the satisfaction of the Engineer, 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.

3.2 PIPE AND FITTINGS INSTALLATION

- A. Using proper equipment, excavate a straight (vertical) and true trench to a depth of 2-inch of pipe invert elevation.
- B. 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 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.
- C. Pipe shall be laid on undisturbed trench bottom provided suitable base is available- no rock; if not, excavate to 2-inch below pipe invert and provide and install sand base or crushed stone upon which to lay pipe.
- D. Backfilling shall be accomplished as follows: the first 10-inch of backfill material shall contain no foreign matter and no rock. 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.
- E. Make solvent-weld joints 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 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).
- F. Mainline pipe shall have minimum 22 inches of COVER (excavate to invert as required by pipe size). Lateral pipe shall have minimum 12 inches of cover (excavate to invert as required by pipe size).
- G. Cut plastic pipe with handsaw or pipe-cutting tool, removing burrs at cut ends. Pipe cuts are to be square and true. Bevel cut end as required to conform to Manufacturer's specifications.
- H. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. When installation of the pipe is not in progress, the open end(s) of the pipe shall be closed by a watertight plug or other means. Pipe, 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 pipe, no additional pipe may be installed or backfilled until 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 of Cambridge. PVC pipe shall be snaked in the trench to accommodate for expansion and contraction due to changes in temperature.

- I. In installing irrigation pipe, 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 roots 1-inch and larger.
- J. Maintain 6-inch minimum clearance between irrigation lines and lines of other trades. Do not install irrigation lines directly above another line of any kind.
- K. Maintain 3-inch minimum between lines which cross at angles of 45 to 90 degrees.
- L. Throughout the guarantee period it will be the responsibility of the Contractor to refill any trenches that have settled due to incomplete compaction.

3.3 ELECTRICAL WIRE CONDUIT INSTALLATION

- A. Electrical conduit shall be installed in non-soil areas, as well as for above ground wiring where wire passes under or through walls, walks and paving to controller.
- B. Conduit shall extend 18 inches beyond edges of walls and pavement.

3.4 IRRIGATION PIPE AND FITTINGS INSTALLATION STRUCTURAL SOIL

- A. Soil media underneath hardscapes-specified by others. See drawings and plans by others.
- B. Lay filter fabric in 12-inch widths centered on proposed perforated pipe locations as shown on details.
- C. Lay 4-inch single wall perforated corrugated pipe at base of aggregate stone level centered on top of filter fabric. Perforations shall be placed toward filter fabric. Pipe shall have three rows of holes with one row centered at pipe invert of pipe.
- D. Connect non-perforated 4-inch single wall corrugated pipe between perforated lines for oxygenation under atmospheric pressure. Bring vent pipe to surface for atmospheric air vents and install brass grates flush to grade.
- E. Soil media filling shall continue to meet requisite grade (as directed by Landscape Architect).
- F. Driplines should be thoroughly flushed. Driplines with aeration pipes should be tested to assure emitters are operating properly before continuing backfilling.
- G. Root ball deep drip stakes should be tested after installation per details. Both structural soil and root balls should be saturated prior to putting irrigation system into operation.

3.5 ISOLATION VALVE INSTALLATION

- A. Install isolation valves per detail where indicated on the drawings. Install 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.
- B. Check and tighten valve bonnet packing before valve box and backfill installation.

3.6 VALVE BOX INSTALLATION

- A. Furnish and install a valve access box for each electric valve, quick coupling valve, isolation valve and flushing valve.
- B. Valve access boxes shall be installed on a minimum 4-inch crushed stone base. Finish elevation of boxes shall be at grade. Supply crushed stone and install before valve box. Crushed stone shall not be poured into previously installed valve boxes.
- C. Valve boxes shall be installed neatly. Boxes shall be parallel or perpendicular to hardscape edges and equidistance to other valve boxes installed in the same location. A sufficient amount of turf shall remain in place between each valve box and between valve boxes and hardscapes
- D. Valve box extensions shall be provided as required on valve boxes in order to install valve box covers at grade.
- E. Bricks, stones, etc. shall not be used to support valve boxes.
- F. Valve box locations within planters and hardscape shall be approved by the Landscape Architect before installation.

3.7 24 VOLT CONTROL VALVE INSTALLATION

- A. 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 bolts, screws and wiring accessible through the valve box opening. Valves shall be set in a plumb position with 24-inch minimum maintenance clearance from other equipment.
- B. Install at sufficient depth to provide more than 6-inch, nor less than 4-inch cover from top of valve to finish grade.
- C. Adjust zone valve operation after installation using flow control device on valve.

3.8 WIRING INSTALLATION

- A. 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 changes of direction. Wiring in valve boxes shall be a sufficient length to allow

the valve solenoid, decoder, splice and connections to be brought above grade for servicing. This additional slack shall be coiled for neatness in the valve box.

- B. Wire shall be laid in trenches and shall be carefully backfilled 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 backfilled. Wires shall have a minimum of 22 inches of cover (See Detail). Wire not to be installed that day shall not be laid out.
- C. An expansion curl shall be provided and installed within 6 inches of each wire connection to a solenoid or decoder on the single #14 wires – do not curl two-wire communication cable. 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.
- D. Service wiring in connection with drawings and local codes for low voltage service. In-ground wire connections shall be waterproofed splice kits. Splices shall be made in valve boxes (wire runs requiring splices between valve locations shall be provided and installed in splice box-valve box shall be used). Splice locations shall be shown on the record drawings.
- E. 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.
- F. Two-wire communication cable shall be installed along mainline path and indicated on the record drawings.

3.9 CONTROLLER INSTALLATION

- A. Controller shall be mounted in the specified VIT Strongbox stainless-steel enclosure, per detail using Baseline or equal mounting kit for the Strongbox or equal enclosure. Wire 2-wire cable and weather sensor into controller and set proper programs.
- B. Hard wire controller to electrical supply at controller location.
- C. Wiring within the enclosure shall be neatly run, bundled, and cinched. Zone cables shall be labeled as to zone/station served at the controller.
- D. Controller shall be installed on a new reinforced concrete base of minimum dimensions shown on the detail, poured-in-place. Expansion shields shall not be used. Contractor to use template to install poured-in-place stainless steel "J" bolts to fasten enclosure to base. Prefabricated controller base shall not be approved for installation.
- E. Install minimum one (1), 1-1/2-inch PVC conduit sweep ell and spool piece through controller pad as required for decoder cable. Install minimum one (1), 1-1/2-inch PVC conduit sweep ell and spool piece through controller pad for #6 AWG bare copper cable. Install minimum one (1), 1-inch PVC conduit sweep ell and spool piece through controller pad for power. Maintain required depth of bury in/out of pad.

- F. Controller power cable, decoder cable and #6 AWG bare copper cable shall be brought to the exterior through separate sleeves in the support pad. Grounding cable shall be installed through the controller concrete pad through a separate 1-1/2-inch sleeve and not through the controller enclosure.
- G. Contractor shall install control and other irrigation-related wiring; as well as 120-volt service to controller.
- H. Above ground cable, other than in controller enclosure shall be installed in conduit.
- I. Grounding system shall be minimum as specified and installed per manufacturer's recommendations. A third party shall certify in writing after testing the results of the grounding system megging readings.
- J. Surge arrestor ground shall be connected to valve common ground of controller.
- K. Seal enclosure sweep holes with expandable foam insulation.
- L. Controller shall be installed level on pad and tight to the base (no gaps).
- M. Keys shall be turned over to Owner's Representative.

3.10 RAIN SENSOR INSTALLATION

- A. Install rain sensor on light pole where indicated on the drawings. Rain sensor should be mounted on side of pole, minimum 12 feet above ground. Coordinate final location of rain sensor with Engineer. Rain sensor shall be in direct contact with the weather. Rain sensor shall be installed in a location so as not to be obstructed from the prevailing wind.

3.11 TUBING STAKE INSTALLATION

- A. 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 and tree rings minimum 3 per ring to prevent movement.

3.12 FLUSH VALVE INSTALLATION

- A. Flush valves shall be installed on drip zones where indicated on drawings.

3.13 SPRINKLER INSTALLATION

- A. ½-inch sprinklers shall be installed flush (perpendicular) to grade on swing pipe assemblies, minimum length 6 inches, maximum 18 inches.
- B. Sprinklers shall not exceed maximum spacing indicated.

- C. Adjust sprinkler zone after installation using flow control device on valve.

3.14 DEEP DRIP STAKE INSTALLATION

- A. Drip stakes to be installed four per tree as shown on the details. Stakes shall have 2 gph emitters installed in the stake. Place tree watering stakes generally as indicated on the drawing and details. Tree stakes shall be placed in the edge of the root ball. Install stake as per the manufacturer's recommendations, to a depth where the top of the cap is flush with finish grade.
- B. ¼-inch distribution tubing shall be installed from the blank drip tubing ring and 18 inches into the tree stakes.
- C. Emitter shall be installed on end of distribution tubing to the bottom of deep drip stake.

3.15 QUICK COUPLING VALVE INSTALLATION

- A. Provide and install quick coupling valves where indicated on the Drawings.
- B. Quick coupling valve to be mounted on 1-inch prefabricated PVC unitized swing joint assembly with integral O-rings, minimum length 12 inches with brass insert and stabilizer as per details.

3.16 IN-LINE EMITTER TUBE INSTALLATION

- A. In-line emitter tubing shall be installed in areas designated (see details) and shall have an average depth of 4 inches unless otherwise indicated on the drawings. Tubing should not be visible through the mulch. In-line emitter tubing shall be installed on the high side of the plant material being watered to help insure dispersion of the water.
- B. In-line emitter tubing is to be installed 6 inches from planter edges, curbs and walls. Spacing of in-line emitter tube is to be 18 inches center-to-center in irrigated areas.
- C. In-line tubing shall have a minimum incoming pressure of not less than 5-psi of the pressure regulator, 45-psi, to assure a maximum linear length of 330 feet at zero elevation lift.

3.17 DRIP PRESSURE REGULATOR

- A. Pressure regulator shall assure a 45-psi downstream pressure entering drip supply header. Pressure shall be verified to assure proper operating pressure for the in-line emitter tubing at maximum linear run of 330 feet. Manifold pressure regulators, where necessary, to reach the mid-range flow of the regulator.

3.18 WATER METER INSTALLATION

- A. Water meter shall be approved by the Cambridge Water Department and installed by the Contractor in water supply enclosure. Water meter shall be 1-inch.

- B. Support equipment in enclosure per detail.

3.19 BACKFLOW PREVENTION INSTALLATION

- A. Install 1-inch reduced pressure backflow prevention assembly in water supply enclosure as detailed. Backflow installation shall be in accordance with Cambridge Cross Connection Department requirements.
- B. Support equipment in enclosure per detail.

3.20 WATER METER/BACKFLOW ENCLOSURE INSTALLATION

- A. Install enclosures on concrete pads as indicated on the detail, generally where indicated on the drawings. Final location of enclosures shall be coordinated with the Engineer as to best screen the enclosures and deter vandalism. Final location shall also be coordinated with utility department to ensure proper placement of water supply line.

3.21 SOIL MOISTURE SENSOR INSTALLATION

- A. Install soil moisture sensors per manufacturers instruction where indicated on the drawings.
- B. Calibrate sensors per manufacturer's instructions.
- C. Assign irrigation zones to appropriate soil moisture sensors and indicate such on the record drawing for each zone.

3.22 GROUNDING INSTALLATION

- A. Two-cable communication path shall be grounded at 600-foot maximum intervals, at every termination of a part of the cable path to a surge arrestor decoder and 50 feet from the controller. Each surge arrestor shall be connected to a 5/8-inch diameter x 8-foot long copper clad grounding rod and 4-inch x 36-inch grounding plate with minimum #10 AWG, solid, bare copper cable. Minimum 8-foot separation between rod and other equipment. Connections to rods shall be with exothermic 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 drainage pipe. Plate shall be installed at a 36-inch depth with 25 lbs. of ground enhancement material spread evenly below the plate and 25 lbs. spread evenly above the plate. Plates shall be covered with 4-inch plastic grated cover with detection and minimum 36 inches of 4-inch drainage pipe. Ground rods and plates shall be UL listed.

3.23 CONTROLLER GROUNDING

- A. Controller 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 rod with minimum #6 AWG, solid, bare copper cable 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 exothermic connectors as specified. Connection to plate shall be performed by the plate manufacturer with 25-feet of bare copper cable 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 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 drainage pipe. Ground rod and plate shall be UL listed.
- B. Controller shall be grounded to one rod and one plate. 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 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 cables connected to the controller.

3.24 CHECK/TEST/START-UP/ADJUST

A. Flushing:

1. After pipe, valves and pipes are in place and connected, but prior to installation of driplines and sprinkler internals, open the control valves and flush out the system under a full head of water.
2. Flush the entire system after installation is complete and service any clogged equipment for thirty (30) days after substantial completion of the irrigation system.

B. Testing:

1. Leakage test: test lines for leaks under operating pressure. Repair leaks and re-test.
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). Engineer will determine if the water coverage is complete and adequate. Readjust sprinkler and dripline locations as necessary or directed to achieve proper coverage.
3. Testing shall be at the expense of the Contractor.

3.25 CLEANING AND ADJUSTING

- A. At the completion of the work, parts of the installation shall be thoroughly cleaned. 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.
- B. Adjust valve boxes, sprinklers and quick coupling valves to grade as required, so that they will not be damaged by maintenance operations.
- C. Each control zone shall be operated for a minimum of 5 minutes and sprinklers and driplines checked for consistency of delivering water. Adjustments shall be made to sprinklers and driplines that are not consistent to the point that they match the manufacturer's standards. 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.

3.26 ACCEPTANCE AND OPERATION BY CITY OF CAMBRIDGE

- A. Upon completion of the work and acceptance by the City of Cambridge, the Contractor shall be responsible for training the City of Cambridge's staff in the operation of the system (provide minimum 7 days written notice in advance of test). Contractor shall furnish, in addition to the Record Drawings and operational manuals, copies of available specification sheets and catalog sheets to the City of Cambridge's personnel responsible for the operation of the irrigation system. Contractor shall guarantee parts and labor for a minimum period of one (1) year from date of acceptance.

3.27 CLEAN UP

- A. Upon completion of installation work, the Contractor shall remove leftover materials and equipment from the site in a safe and legal manner.
- B. Contractor shall remove debris resulting from work of this section.
- C. Contractor shall fill depressions and eroded channels with sufficient soil mix to adjust grade to ensure proper drainage. Compact lightly, and replant filled areas in accord with drawing requirements.

PART 4 – COMPENSATION

Item 2810.1 – Irrigation System – Inman Square

4.1 METHOD OF MEASUREMENT:

Measurement for Irrigation System will be on a lump sum basis for the complete system, complete with incidentals.

4.2 BASIS OF PAYMENT / INCLUSIONS:

Payment for this item will be on a percent of the Lump Sum bid as approved by the Engineer on a monthly basis. The lump sum price bid for this item shall constitute full compensation for furnishing and installing the system complete in place, including but not limited to saw cutting, excavation of materials encountered, backfill including sand and crushed stone, controller, rain sensor, enclosures and concrete enclosure base, pipe, sleeving, control conduit and wiring, control pull boxes, valves, flushing and testing, coordination with electrical service provider, cleaning and touch-up, protecting the items from damage, and cutting and patching required to complete the installation as indicated and specified.

4.3 SPECIAL NOTES ON EXCLUSIONS:

Disposal of excavated soil not suitable for re-use is not included for payment under this item and shall be paid for separately.

END OF SECTION 02810

SECTION 02890

TRAFFIC SIGNALS

2890.1	TRAFFIC SIGNAL RECONSTRUCTION – LOCATION 1 LUMP SUM INMAN SQUARE	
2890.2	3 INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC (UL)	LINEAR FOOT
2890.3	4 INCH ELECTRICAL CONDUIT TYPE NM - PLASTIC (UL)	LINEAR FOOT
2890.4	PULL BOX 12” X 12”	EACH
2890.5	PULL BOX 24” X 12”	EACH
2890.6	SERVICE CONNECTION EVERSOURCE APPROVED HANDHOLE	EACH

PART 1 - GENERAL

WHERE REFERENCE IS MADE HEREIN 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).

Work under the above items shall be performed according to the provisions of Section 800 of the MassDOT Standard Specifications. Traffic signal work includes the intersection of Inman Square.

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, green and light rail transit LED signal modules including bicycle signals, posts and bases, anchor bolts and foundations, video detection, loop detectors and amplifiers, service connections, fire station preemption, wire and cables, conduit, pull boxes, hand holes, 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.

PART 2 – PRODUCTS AND EXECUTION

3 Inch Electrical Conduit Type NM – Plastic (UL)

Inman Square Intersection
Safety Improvement Project
Issued for Bid

TRAFFIC SIGNALS
02890-1

4 Inch Electrical Conduit Type NM – Plastic (UL)

The 3 inch Electrical Conduit, Type NM and 4 inch Electrical Conduit shall be installed as indicated on the plans and as directed by the Engineer.

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 Items 2890.1.

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 Items 2890.2 and 2890.3.

Conduit in Roadways

Trenches in existing bituminous concrete pavements shall be sawcut to 18 inches wide. The existing pavement shall be sawcut through its full depth and the pavement removed.

Trench bed shall be prepared in accordance to MassDOT and City standards. 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.

Traffic Signal Pull Boxes – SD2.022 and SD2.031 (Traffic)

Work under this section shall consist of furnishing and installing 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 excavation relative to these item shall be included as part of Items 2890.4 and 2890.5. Units shall be precast concrete as shown on MassDOT Standard Drawings SD2.022 and SD2.031. Handhole covers shall be clearly marked "TRAFFIC".

Traffic Signal System

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

Changes from automatic flashing to stop-and-go operation and from stop-and-go to automatic flashing operation shall occur as set forth in Sections 4D.28 through 4D.31 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 controller cabinet foundation shall not obstruct a sidewalk or crosswalk so that passage by physically challenged persons is impaired. Anchor bolts shall be internal to the cabinet.

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 shall be a Siemens m60 Series ATC Controller or approved equal. The controller and cabinet assemblies shall be supplied in a 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 traffic controller unit shall have Peer-to-Peer (P2P) capabilities to communicate with controllers at adjacent intersections. Controller cabinet shall be size "M" type box.

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 cabinet shall also be wired with a normally closed switch connected to a user defined input to the controller for remote monitoring of the control cabinet's door open status.

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 unit shall meet all applicable requirements of the NEMA 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 City.
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.
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.

The power supply shall be either shelf mounted or wall mounted utilizing keyhole 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 unit's 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 two-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 two output indicator lights which will show flashing power out to the cabinet assembly.

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.

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 and Bicycle Signal Heads

All proposed vehicle and bicycle 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 phase. The confirmation LED shall meet or exceed the specifications of the model PPB-LED or approved equal.

Tactile pedestrian push buttons shall be 4-wire accessible pedestrian signal with vibro-tactile and directional (right or left) arrow with Red LED confirmation light, ped head control unit and 12' harness – painted yellow with rapid tock walk sound. The assembly shall include a saddle to accommodate a 5"x7" standard sign providing guidance on pedestrian signals, including in Braille for visually impaired persons.

Each visual pedestrian indication shall be complemented by an audible pedestrian indication. The audible 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.

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 and Yellow 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.

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.

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.

Mast Arm #2 shall have a shorter shaft height than standards, to avoid adjacent tree canopy to the greatest extent possible.

The lump sum prices bid should assume the dimensions shown on the MassDOT Standard Drawings for a four-foot (4') diameter foundation. Soil exploration borings shall be conducted by the Contractor and paid for under Item 2210.1. 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 inches. In sidewalk or paved areas, the top of all signal post foundations shall not be exposed.

Where a traffic signal post houses only 3 section, 4" lens signal heads, the signal post shall be 8' tall.

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, preempt, phase selector, detectors, etc. All 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 with lightning protection. 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	-	black
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.

Removing and Stacking Existing Signal Equipment

Existing traffic signal equipment within the project limits shall be removed and stacked by direction of the Engineer. Existing traffic signal equipment to be removed and stacked shall include, but not be limited to, traffic signal heads, backplates, pedestrian push buttons, signs and saddles, traffic signal posts, mast arms, traffic signal controller, cabinet, loop detector amplifiers, hangers or brackets, and any other materials not necessary for the final signal operation.

All traffic signal equipment to be removed and stacked shall be delivered to the City of Cambridge DPW yard, or an alternate location as designated by the Engineer.

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, hand holes 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.

PART 4 - COMPENSATION

Item 2890.1 – Traffic Signal Reconstruction Inman Square

METHOD OF MEASUREMENT:

Measurement for payment of Item 2890.1 will be based on full completion as approved by the Engineer.

BASIS OF PAYMENT/INCLUSIONS:

The lump sum price bid for Item 2890.1 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, electrical conduit and wiring, electric handholes, frames and covers, 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.

EXCLUSIONS:

No separate payment shall be made for sand bedding, marking tape, controlled density fill, temporary top course hot mix asphalt pavement, or any incidental materials, but all costs in connection therewith shall be included in the Contract unit price for Items 2890.1.

Item 2890.2 – 3 Inch Electrical Conduit Type NM – Plastic (UL)

Item 2890.3 – 4 Inch Electrical Conduit Type NM – Plastic (UL)

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, and cleaning as indicated on the Drawings and Specifications, or as directed by the Owner or Engineer. This work shall include furnishing, installing, and/or performing the following: gravel pavement subbase; pavement or sidewalk sawcutting; removal of loop detectors; removal of brick, concrete, or bituminous sidewalk; 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; sanitary sewer and storm drain flow handling; removal of groundwater from the trench; handling groundwater recharged back to the soil; filter fabric as required; bedding, including compaction; 3 inch electrical conduit pipe, fittings, couplings, and appurtenances; connections to structures; cleanout assemblies (if required); placing and compacting suitable backfill soil; grade and compact gravel pavement sub-base; and all appurtenances and incidental work.

Payment for 3 Inch Electrical Conduit Type NM - Plastic (UL) and 4 Inch Electrical Conduit Type NM - Plastic (UL) shall be paid at the Contract unit price per linear foot of complete and functional conduit installed as shown on the Contract Drawings or as directed by the Owner or Engineer. Measurement shall be taken 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.

Item 2890.4 – Pull Box 12” X 12”

Item 2890.5 – Pull Box 24” X 12”

Payment for Pull Box 12” X 12” and Pull Box 24” X 12” shall be paid at the Contract unit price per each pull box installed under Items 2890.4 and 2890.5, which shall include all labor, material, equipment and incidental costs required to complete the work.

Item 2890.6 – Service Connection Eversource Approved Handhole

METHOD OF MEASUREMENT:

Measurement for payment of Item 2890.6 will be based on the number of completed Service Connection to Eversource Approved Handholes as specified herein and as measured by the Engineer.

BASIS OF PAYMENT/INCLUSIONS:

Payment for Item 2890.6 shall be based on the per number of individual Service Connections made to Eversource Approved Handholes for the traffic signal system. Under the per each price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required complete the service connection. 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; coordination with Eversource including obtaining a Eversource Work Order; payment for any fees associated with the Eversource Work Order; and incidental work not included for payment elsewhere.

END OF SECTION 02890

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SECTION 02900

LANDSCAPING

2900.1

PLANTING AREAS

LUMP SUM

PART 1 – GENERAL

1.1 SUMMARY

- A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all planting work and preparation of street tree planting pits and related items as indicated on the Contract Documents and as specified in this Section and includes, but is not limited to, the following:

1. Trees
2. Shrubs
3. Perennials, grasses and ferns
4. Grades and standards of plants
5. Root systems for all plants
6. Wood cellulose fiber mulch
7. Mycorrhizal fungal inoculant
8. Fertilizer
9. Mulch
10. Water
11. Antidessicants
12. Limestone

1.2 RELATED WORK

- A. Section 02810 – IRRIGATION
- C. Section 02901 – PLANTING SOILS

1.3 SHOP DRAWING SUBMITTALS

- A. Shop Drawings:
1. Submit list of sources for plant material and tagging trip schedule within 60 days of awarded contract.
 2. Certify, invoice, and order plants for each shipment grown, free of disease and insect pests. Submit certificates to Engineer.
 3. Prior to placement of any mulch, deposit, at a location on site suitable to Engineer, 1/2 cu. yd. sample of mulch for examination. After mulch

sample is reviewed by the Engineer, provide mulch conforming to accepted sample.

4. Submit to Engineer project literature for each type of fertilizer, anti-desiccant and mycorrhizal fungal inoculant.
5. Prior to end of maintenance period, furnish two copies of written maintenance, instructions for maintenance and care of installed plants.

1.4 QUALITY ASSURANCE

- A. Investigate sources of supply and make assurances that plants will be supplied as indicated in Schedule of Plant Material in sizes, variety and quality noted and specified **before submitting bid**. Failure to take this precaution will not relieve responsibility for furnishing and installing plant material in accordance with Contract requirements and without additional expense to Owner.
- B. Upon delivery and before planting, Engineer will observe plants. Evaluation and approval by Engineer of plants is for quality, size and variety only and in no way impairs the right of rejection for failure to meet other requirements during progress of work.
- C. General:
 1. Provide only nursery grown plants having been transplanted at least once and growing in a nursery for at least two years. Allow Engineer to determine fitness of any plant.
 2. Provide container-grown stock in containers long enough for root system to develop sufficiently to hold soil together firm and whole when removed from container. Use no plants loose in the container.
 3. Check plant material prior to commencing of planting operations. Plant no material prior to inspection by Engineer. Notify Engineer at least 48 hours in advance of all planned planting operations and identify specific material and its location.
 4. Furnish suitable quantities of water, hose and appurtenances.
 5. Correct defective work as soon as possible within guarantee period. Repair or replace plants, and shrubs which, in judgment of Engineer, have not survived and grown in a satisfactory manner, for a period of two years after acceptance.
 6. Provide as specified seedings or plantings replacements of the same type and size as specified.
 7. The City does not guarantee the locations of existing pipes or

underground conduits. The locations of these structures shown on City engineering plans are approximate. In private and public lands where sprinkler systems, driveways, walks, steps, walls and heating cables and or heating pipes are encountered, the Contractor shall use due caution when excavating in the vicinity of these structures and will be required to repair any damages caused at the Contractor's expense.

8. All work shall be done in a safe and workman-like manner, in compliance with the rules and regulations of the Division of Industrial Safety and all other City and State agencies and authorities having jurisdiction of the types of work included in this Contract.
9. Horticulturally skilled workers, trained and experienced in accepted nursery and arboriculture practices shall perform the planting. The work shall be done in a workmanlike manner under the supervision of a qualified planting supervisor demonstrating a background in landscape operations. It is required that the planting supervisor be a Massachusetts Certified Arborist, I.S.A. Certified Arborist or equivalent pending the City Arborist's approval and as defined in Section 1.04.A.13.
10. The Contractor shall supply sufficient personnel to perform the work in accordance with the applicable specifications and conditions listed herein. The Contractor shall employ only qualified, competent personnel to do the work; and whenever the City shall notify the Contractor in writing, that a person in charge of, or on the work site, is not working in a workmanlike manner or is incompetent, unfaithful, disorderly, unsafe, under the influence of liquor and/or drugs, using insolent or improper language or is otherwise unsatisfactory in any manner, or not employed in accordance with the provisions of this contract, such persons shall no longer be assigned by the Contractor to perform work called for under the terms of this contract. The Contractor is responsible for administering any drug/ alcohol testing of his/her employees as required by State and Federal agencies. The Contractor must inform the City with proper documentation that such random testing was performed.

1.5 STORAGE AND HANDLING OF MATERIALS

- A. Store plants in ground or other acceptable media if not to be planted within 4-hrs of arrival to project site. Protect roots of plant material from drying or other possible injury. Water plants as necessary until planted.

- B. Do not drop plants. Do not pick up container or B & B (ball and burlap) plants by stem or trunks.

1.6 WARRANTY

- A. Provide as specified in Section 3.8 PLANT GUARANTEE of this specification section.

PART 2 – PRODUCTS

2.1 TREES

- A. Species as noted and specified in the PLANT SCHEDULE.

2.2 SHRUBS

- A. Species as noted and specified in the PLANT SCHEDULE.

- B. All shrubs shall meet the following standards

1. All shrubs shall be healthy and vigorous plants which are very well shaped, heavily branched, densely foliated, and true to form for the variety.
2. Canes or Trunk(s) and Branches:
 - a. Well formed and sturdy.
 - b. Branching shall be uniformly distributed close to the ground.
 - c. Scars shall be free of rot and not exceed 1/4 the diameter of the wood beneath in greatest dimension unless completely healed (except pruning scars).
 - d. Pruning scars shall be clean cut and shall leave little or no protrusion from the trunk or branch.
 - e. Graft unions shall be completely healed.
 - f. No suckers or water sprouts.
 - g. Contain no dead wood.
 - h. Free of cracks, splits, or cambium peeling.
3. No shrub with pest or mechanical damage will be accepted.
4. Shrubs shall show no signs of frost or winter damage to the foliage. Foliage shall not be in a state of drought stress. Leaves or needles shall show no signs of wilt or desiccation due to weather stress at any season of the year.

2.3 PERENNIALS, GRASSES AND FERNS

- A. Species as noted and specified in the PLANT SCHEDULE.
- B. All perennials, grasses and ferns shall meet the following standards:
 - 1. Perennials, grasses and ferns shall be healthy and well cared for, with no evidence of insects or diseases present. Insect-ridden or diseased plants shall be rejected. Plants shall have a deep green foliage and dense, compact growth. Perennials, grasses and ferns shall have multi-stemmed bases and shall be two year potted stock minimum, one year in cutting bench and one year in pots.

2.4 GRADES AND STANDARDS OF PLANTS

- A. The Contractor shall furnish all plants shown on the Contract Documents, as specified, and in quantities listed on the PLANT SCHEDULE. No substitutions will be permitted, without written approval by the Landscape Architect. All plants shall be nursery grown unless specifically authorized to be collected as noted on the PLANT SCHEDULE.
- B. All plants shall be typical of their species or variety and shall have a normal habit of growth and be legibly tagged with the proper name. Only plant stock grown within Hardiness Zones 1 through 6b, as established by the USDA Plant Hardiness Zone Map, latest edition, will be accepted.
- C. Plants shall be in accordance with ASNS Standards of the American Association of Nurserymen except as noted in this Section. Botanical plant names shall be in accordance with plant designations included in Hortus III.
- D. If, at any time during the performance of the Contract, any plant shows signs of graft incompatibility, as determined by the Landscape Architect, then the tree or shrub and all other similarly grafted plants of the same Genus/Species/Variety shall be rejected and removed from the site. Visual symptoms of graft incompatibility as cause for rejection include:
 - 1. Development of over-growths by rootstock or scion resulting in the development of shoulders or inverted shoulders.
 - 2. Suckering of the rootstock combined with poor growth or dieback of scion.
 - 3. Any mechanical weakness between scion and rootstock.
 - 4. Any marked difference in bark pattern and structure between scion and rootstock.

2.5 ROOT SYSTEMS FOR ALL PLANTS

- A. Each plant shall have an extensive, symmetrically balanced fibrous root system. Any root ball which shows signs of asymmetry, injury, or damage to the root system shall be rejected.

- B. Curling or spiraling of the roots along the walls of rigid containers will not be accepted.
- C. All parts of the fibrous root system of all plants shall be moist and fresh with a white color when washed of soil. When the plant is removed from the container, the visible root mass shall be healthy with white root tips. The root systems of all plants shall be free of disease, insect pests, eggs, or larvae.
- D. All trees and all shrubs which are not grown in containers must be moved with the root systems as solid units with balls of earth firmly wrapped with untreated 8 ounce natural, biodegradable fabric burlap, firmly laced with stout, natural biodegradable cord or twine. The base of the tree trunks shall be wrapped with a protective burlap layer, surrounded by a cardboard trunk protector, and loosely tied with twine.
- E. The diameter and depth of the balls of earth must encompass the fibrous and root feeding system necessary for the healthy recovery of the plant. Minimum root ball diameters and depths shall be in accordance with ASNS standards.
- F. No plants shall be loose in the container.
- G. Container grown plants which have roots growing out of the container will be rejected.

2.6 PLANTING SOIL MIX

- A. Planting soil mix shall be an approved amended native soil specified, provided, installed and paid for under Section 02901 PLANTING SOILS, and that has been pH adjusted according to particular planting applications and improved through the addition of organic matter as directed below. Planting soil shall conform to the following pH levels:
 1. For broad-leaved evergreens requiring an acid soil, planting soil mix shall have a true pH of 4.5 to 5.5. Planting soil mix shall be amended by the Contractor at his own expense to the proper pH range by mixing with sulfur as specified, provided, installed and paid for under Section 02901 PLANTING SOILS. Broad-leaved evergreens include but are not limited to the following genuses: Kalmia and Ilex.
 2. Planting soil mix for general planting of non-acid loving plants shall have a true pH value of 6.0 to 6.5. Planting soil mix shall be amended by the Contractor at his own expense to the proper pH range by mixing with dolomitic limestone as specified, provided, installed and paid for under Section 02901, PLANTING SOILS.
 3. The amount of either sulfur or limestone required to adjust the planting soil mix to the proper pH range shall be approved by the Landscape Architect on the basis of soil tests as specified, provided, installed and paid for under Section 02901 PLANTING SOILS.

2.7 SOIL ADDITIVES

- A. Soil additives shall be specified, provided, installed and paid for under Section 02901 PLANTING SOILS.

2.8 MYCORRHIZAL FUNGAL INOCULANT

- A. Mycorrhizal fungal inoculant shall be live spores packaged in plastic packets. At a minimum each packet of inoculant shall contain the following:
 - 1. Live spores of VA Endomycorrhizal fungi: Vesicular-Arbuscular mycorrhizae fungi, minimum of 8 species.
 - 2. Live spores of Ectomycorrhizal fungi: including *Pisolithus tinctorius*.
- B. Mycorrhizal fungal inoculant shall be manufactured by:
 - 1. Plant Health Care Incorporated, 440 William Pitt Way, Pittsburgh, PA 15238, telephone: (800) 421-9051;
 - 2. Horticultural Alliance, 2946 Louise Street, Sarasota, FL 34237, (800) 628-6373;
 - 3. BioPlex Organics, 2213 Huber Drive, Manheim, PA 17545 (800) 441-3573,
 - 4. Or approved equal.

2.10 FERTILIZER

- A. Fertilizer shall be the unique feeder 16-8-16 controlled, slow-release fertilizer packets (8 yr), as manufactured by Osmocote, or approved equal.

2.11 MULCH

- A. Mulch shall be high quality, double-ground, premium bark mulch of 70 percent hemlock bark with the balance spruce and pine bark. Mulch shall have been aged for a minimum of six months and not longer than two years. Bark mulch shall be shredded to a uniform size; free of dirt, debris and foreign matter; with pieces no thicker than 1/4 in. Mulch must be free of stringy material or chunks over 3 inches in size and shall not contain, in the judgment of the Landscape Architect, an excess of fine particles. Bark Mulch shall be a well-graded material conforming to the following:
 - 1. pH between 4.0 – 8.0
 - 2. Particle size 100% passing a 50mm (2 inch) screen
 - 3. Soluble salt content < 4.0 mmhos/cm

2.12 WATER

- A. The Contractor shall be responsible to furnish his own supply of water to the site at no extra cost. If possible, the Owner shall furnish the Contractor upon request with an adequate source and supply of water at no charge. However, if the Owner's water supply is not available or not functioning, the Contractor shall be

responsible to furnish adequate supplies at his own cost. All work injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct. Water shall be free from impurities injurious to vegetation.

2.13 ANTIDESICCANTS

- A. Antidesiccants shall be emulsions or other materials which will provide a protective film over plant surfaces permeable enough to permit transpiration and specifically manufactured for that purpose. Manufacturer of antidesiccant shall be subject to the Landscape Architect's approval and shall be used only after approval by the Landscape Architect. Antidesiccant shall be delivered in containers of the manufacturer and shall be mixed and applied according to the manufacturer's instructions.

2.14 LIMESTONE

- A. Ground limestone for adjustment of loam borrow pH shall contain not less than 85 percent of total carbonates and shall be ground to such fineness that 40 percent will pass through 100 mesh sieve and 95 percent will pass through a 20 mesh sieve. Contractor shall be aware of loam borrow pH and the amount of lime needed to adjust pH to specification in accordance with testing lab recommendations.

PART 3 – EXECUTION

3.1 GENERAL

- A. It is the intent of this specification that existing trees within grading and seeding limits, not disturbed by building operations, be saved and protected, except where specified to be removed. Tree clearing, protection, and planting shall be performed based on the applicable specification sections and as indicated in the drawings or by the Engineer. Engineer requires variations required in grading on the job.

3.2 PLANTING

- A. Furnishing and planting of plant material shall include, but shall not be limited to, the digging of planting pits and plant beds, amendment of loam as required to produce planting soil mix, provision of soil additives required to adjust for pH requirements of specific plants, furnishing the plants as specified as well as the labor of planting, fertilizing, and maintenance.
- B. Prior to spreading of loam, subgrades shall have been tested to determine if they are too compact to drain water as specified, performed and paid for under the work of Section 02901, PLANTING SOILS, of this Specification.
- C. The Contractor shall locate plant material sources and ensure that plants are

shipped in timely fashion for installation.

- D. Contractor shall locate all existing underground utilities that are within 10 feet of the proposed planting pits and notify the Landscape Architect of any conflicts prior to digging plant pits.
- E. Seasons for Planting:
1. Spring: Deciduous materials - March 31 through June 15; Evergreen materials - April 27 through June 15.
 2. Fall: Deciduous materials – August 15 through October 1; Evergreen materials - August 15 through October 1.
- F. Plant Material Inspection:
1. At least one month prior to the expected planting date, the Contractor shall request that the Landscape Architect provide a representative to select and tag stock to be planted under this Section 02900, LANDSCAPING. The Contractor shall pay for the transportation, subsistence and overnight accommodations, if necessary, for the Landscape Architect's representative during the period of time required to select and tag the plant material.
 2. The Contractor shall be responsible to certify the availability of quality plants in specified sizes from his/her sources of supply prior to requesting that the Landscape Architect make plant source inspections. In the event that plants at the inspection location are found to be unavailable or of insufficient size, the Contractor shall be liable to reimburse the Owner for all costs of the Landscape Architect's hourly services which are incurred during unproductive inspection trips.
 3. Unless specifically designated otherwise, a representative of the Contractor shall accompany the Landscape Architect on all plant material selection field trips.
 4. All trees for the project shall be individually tagged for approval with the Landscape Architect's seals, and no trees shall be accepted for delivery to the site without such seals. Representative samples only of shrubs and ground cover plants may be tagged or marked for approval as an "Approved Typical Sample" and shipped to the site. Any shrub or groundcover plant that arrives at the construction site that does not meet the Approved Typical Sample will be rejected by the Landscape Architect.
 5. Inspection and approval of plants at the source shall not impair the right of subsequent inspection and rejection upon delivery to the site, or during the progress of the work if the Landscape Architect finds that plants do not meet the requirements of the PLANT SCHEDULE or this Contract, have declined noticeably due to handling abuse, lack of

maintenance, or other causes. Cost of replacements, as required, shall be borne by the Contractor.

G. Placement of Loam for planting soil shall be specified, performed and paid for under the work of Section 02901, PLANTING SOILS, of this Specification. Obtain Landscape Architects written approval of work of rough grading and finish grading prior to starting the work of planting.

H. Planting:

1. Notify the Landscape Architect three working days prior to the proposed arrival of plant material on the site. If not planted within 24 hours of delivery to the site, all plants shall be maintained in an on-site nursery. Container grown shrubs stored on site shall be shaded from direct sunlight at all times and shall not be stored directly on paved surfaces. All plants delivered to the site and not planted within 24 hours of delivery shall have their root balls covered with mulch and shall be watered on a daily basis such that root balls are kept moist throughout.
2. Locations for all plants and outlines for planting areas shall be staked on the ground by the Contractor for approval by the Landscape Architect before any plant pits or plant beds are dug. Notify the Landscape Architect no less than 3 days prior to desired date of inspection of staking to schedule site visit.
3. All plant pits dug with a machine shall have the sides of the holes scraped with hand shovels to prevent glazing or compaction of the sides of the hole. Remove and stockpile excavated loam for reuse as backfill for plant pit. All subsoil excavated from the bottoms of planting pits shall be removed from the site.
5. Plant pits shall be dug to the dimensions shown on the Contract Documents.
 - a. Plant pits for trees shall be a minimum three times the diameter of the root ball. Place root ball directly on subgrade. Slope sides of tree pits at a 45 degree angle.
 - b. Plant pits for shrubs shall be 2 feet greater in diameter than the diameter of the root ball. Place root ball directly on subgrade. Slope sides of tree pits at a 45 degree angle.
 - c. Shrub planting beds shall be excavated and backfilled with planting soil mix to a minimum uniform depth of 24 inches below final grade, or as shown on the Contract Documents.
 - d. Plant pits shall be dug to the depth of the rootball to be planted. Remove all soil from around the root flare of the stem of the plant and from the top of the rootball to determine the true depth of the rootball. All plants that have been planted and have root flares that are buried will be rejected.

6. Perennial, grass and fern beds:
 - a. Perennial, grass and fern beds shall be dug to a continuous depth of 1 foot below final grade, or as shown on the Contract Documents. Place sufficient planting soil mix to provide 1 foot deep beds. Remove groundcover and perennials from their pots immediately before planting. Handle plants carefully to prevent damaging roots. Place each plant in individual hole and firm the planting mix around the roots. Water thoroughly and mulch as shown on the Contract Documents. Groundcover plants may be planted after the planting mulch is placed.
7. All plant roots and earth balls must be damp and thoroughly protected from sun and wind from the beginning of the digging operation, during transportation, and at the site until the final planting.
8. Remove container plants from containers prior to planting.
9. Trees and shrubs shall be placed in the center of plant pits, plumb, with the crown of their roots exposed and located above the surrounding finish grade.
10. Prior to completion of planting installations, remove rope and cut wire baskets from the top 1/3 of the root balls. Pull burlap away from the trunk or stem of the plant and cut burlap from the top 1/3 of the root balls.
11. Contractor shall 'butterfly' the root system for all container grown perennials immediately prior to planting them. Butterflying shall consist of vertically cutting the containerized root ball with a spade through the bottom half of the rootball followed by gently pulling the rootball open at the cut while placing it into the planting hole. The butterflied root system shall be placed over a small ridge of soil in the planting pit in order to assure as much soil to root ball contact as possible and to keep the halves apart.
12. Existing loam excavated from the planting pit and new loam meeting the requirements of these specifications shall be reused for backfilling the rootball. Existing loam and new loam shall be wedged under the curve of the rootball sufficiently to support the rootball and to keep the trunk of the tree plumb during planting soil placement. Under no circumstances shall depth of backfilled material be such that the remaining volume left for backfilling the planting soil is less than 18 inches. Do not use excavated subsoil in backfill.
13. Planting soil shall be backfilled in layers and as described in Section 02901 Planting Soils. Enough planting soil shall be used to bring the finished surface of the planting pit to 2 inches above finished grade at plant stem when planting soil backfill has settled. A saucer shall be formed around each plant at a depth of 6 inches for trees and 4 inches for shrubs.

14. Fertilizer shall be spread over the plant saucer or plant bed between the saucer and the edge of the rootball. Till the fertilizer into the soil to a depth of four inches prior to the placement of the planting mulch. Fertilizer shall be provided, spread and paid for under the Section 02901, PLANTING SOILS, of this Specification. Do not mulch until placement of the fertilizer has been verified by the Landscape Architect. Fertilizer application rates shall be as determined by soil testing, analysis, and testing laboratory recommendations specified, performed and paid for under the Section 02901, PLANTING SOILS, of this Specification.
- I. All plants shall be watered immediately following planting as necessary to thoroughly moisten rootball and plant pit loam and thereafter shall be inspected frequently for watering needs and watered, as required, to provide adequate moisture in the planting pit. The Contractor shall inspect tree pits 24 hours after initial watering to confirm that they are draining properly. If surface water or excessively saturated plant pit soils exist, the Contractor shall immediately notify the Landscape Architect. The Landscape Architect will recommend remedial measures based upon site conditions.
 - J. Keeping Trees Plumb:
 1. Contractor shall keep trees plumb and upright at all times. To this end the Contractor shall either;
 - a. Stake, guy, or anchor all trees; or
 - b. Monitor plants on a regular basis and, if a tree is moved out of plumb, then straighten the tree to a vertical, upright condition.
 2. If Contractor chooses to keep trees plumb and upright by staking, guying, or anchoring, then the work of this item shall be performed at the time of planting, unless otherwise approved or directed by the Landscape Architect. Stakes shall be of even height, plumb and neat in appearance and they shall not injure plant balls. Anchoring devices shall be applied as follows:
 - a. Soft steel guy wires shall be double stranded and secured to each stake with a central tightening loop. Thread wires through reinforced rubber hose at tree trunk.
 - b. Drive anchors shall be installed in accordance with manufacturer's instructions.
 - c. Diagonal cables shall receive one flag per cable to promote visibility and prevent tripping hazards.
 - d. Elastic webbing, belting or tape shall be installed in accordance with manufacturer's instructions.
 3. If Contractor chooses to keep trees plumb and upright by resetting trees that move out of vertical alignment, then the work of this item shall include:

- a. Tree inspections on a weekly basis and after storms or abnormally windy days to determine if the trees have shifted out of vertical alignment and require resetting.
 - b. Reset trees that have moved out of plumb by carefully excavating the soil from the base of the rootball facing away from the direction of tilt and easing the tree upright into a vertical, plump position. Upon righting the tree, firmly press the soil around the base of the rootball to reset the tree.
 - c. The Contractor shall retain the right to stake, guy, or anchor the tree into place in accordance with the requirements of this Section 02900, LANDSCAPING .
 - d. Mulch and water the tree in accordance with the requirements of this Section 02900, LANDSCAPING, immediately after the work of resetting.
- K. Mulch material shall be placed over entire saucer areas of individual trees and shrubs and over the entire area of planting beds to a depth of 3 inches after settlement, not later than one week after planting. Do not apply mulch prior to the first watering of plant materials. Do not apply mulch prior to placement of surface applied fertilizer and verification of placement by the Landscape Architect.
- L. The trunks of all deciduous trees over 1-1/2 inches in diameter shall be wrapped by the Contractor immediately after the inspection of the trees by the Landscape Architect. Wrapping shall extend from the ground line to the height of the second branches or to the height directed. The specified wrapping shall be wound spirally, starting from the base and overlapping 1-1/2 inches in order to shed water. Wrapping shall be securely taped to prevent loosening and unraveling. If trees are planted in springtime, do not apply any tree wrapping. If deciduous trees are planted in the autumn, wrap the trees and then remove wrapping the following spring.
- 1. Trees delivered to the site wrapped for protection shall be unwrapped at the site for inspection of the trunk by the Contractor and Landscape Architect.
- M. Antidesiccant shall be applied to all evergreen and broadleaf evergreen plants in December and again in February, according to manufacturer's application recommendations and as directed by the Landscape Architect.
- N. If planting is done after turf and grass preparation or installation, proper protection of seeded areas shall be provided. Any damage resulting from planting operations shall be repaired immediately at no cost to the Owner.
- O. In the event that rock or underground construction work or obstructions are encountered in any plant pit or bed excavation work, alternate locations will be selected by the Landscape Architect. Relocation of plant pits or beds shall be

provided at no additional cost to the Owner. Provide the Landscape Architect with no less than 48 hours notice of obstruction so that a site visit can be scheduled to establish new locations for plants.

- P. Absolutely no debris may be left on the site. Repair any damage to site as directed by the Landscape Architect, at no additional cost.
- Q. All replacements shall be plants of the same kind and size specified in the PLANT LIST. The cost shall be borne by the Contractor, except for possible replacements due to vandalism or neglect on the part of others.

3.4 PLANT MAINTENANCE

- A. Maintenance shall begin immediately after each plant is planted and shall continue for a minimum 30-day Monitoring Period and until the end of the fall planting season following Final Acceptance.
 - 1. Plants shall be inspected for watering needs at least twice each week and watered to promote plant growth and vitality. The following watering rates assume that the soil is free draining. If the on-site conditions do not ensure a free draining soil, then notify the Landscape Architect in writing of this condition. Watering rates for trees, shrubs, ground cover, vines and perennials in free draining soils are presented here as guidelines to ensure that the top six inches of plant bed soil remains moist at all times. Actual watering rates may vary depending upon soil conditions. Guideline rates shall be as follows:

<u>Type of Plant/Size</u>	<u>Weekly Watering Rate</u>
<u>Deciduous Trees:</u>	
1 - 1-1/2 in. caliper	40 gallons
1-1/2 - 2 in. caliper	54 gallons
2 - 2-1/2 in. caliper	61 gallons
2-1/2 - 3 in. caliper	70 gallons
3 - 3-1/2 in. caliper	80 gallons
3-1/2 - 4 in. caliper	90 gallons
4 - 4-1/2 in. caliper	100 gallons
4-1/2 - 5 in. caliper	110 gallons
5 - 5-1/2 in. caliper	120 gallons
5-1/2 - 6 in. caliper	130 gallons

<u>Type of Plant/Size</u>	<u>Weekly Watering Rate</u>
<u>Evergreen Trees:</u>	
1 - 2 ft. height	25 gallons
2 - 3 ft. height	30 gallons

3 - 4 ft. height	35 gallons
5 - 6 ft. height	40 gallons
6 - 7 ft. height	45 gallons
7 - 8 ft. height	50 gallons
8 - 9 ft. height	60 gallons
9 - 10 ft. height	70 gallons
10 - 11 ft. height	80 gallons
11 - 12 ft. height	90 gallons

Shrubs:

Up to 2 ft. height	10 gallons
2 - 4 ft. height	20 gallons
4 - 6 ft. height	30 gallons
6 - 8 ft. height	40 gallons

Perennials, Grasses and Ferns: 5 gallons

- a. Water shall be applied by 1 inch diameter hose.
2. For trees in mulched beds, apply water to the ground surface directly under the canopy. Water shall be applied at a sufficiently slow rate to prevent run off from the soil surface but great enough to equal 0.2 inches of water per square foot of canopy area per hour for 5 hours per week.
3. Stakes shall be kept plumb and neat in appearance. Guys, wires and anchoring cables shall be tightened and repaired weekly.
4. Planting beds and individual plant pits shall be kept free of weeds, and mulch shall be replaced as required to maintain the specified layer of mulch. Beds and individual pits shall be neat in appearance and maintained to the designed layout.
5. Plants that die during the maintenance period shall be removed and replaced by the Contractor within one week of notification and replaced during that growing season, unless directed otherwise by the Landscape Architect.
6. Spraying of insecticides or herbicides shall be done by State-licensed professionals. Spraying for insects, pests and diseases shall conform to the National Arborist Association Standards under the section entitled "Standards for Pesticide Application Operations", as currently adopted and as approved by the Landscape Architect. All insecticides, pesticides, and herbicides shall be EPA-approved and shall conform to the requirements MCRG: Massachusetts Control Recommendation Guide for Insect, Disease, and Weed Pests of Shade Trees and Woody Ornamentals, latest edition, University of Massachusetts, Amherst, College of Food and Natural Resources.

7. Work of pruning, fertilizing, spraying, and similar activities shall be undertaken only by Certified Arborists and licensed chemical applicators, as pertinent to the work being performed.
- B. During the maintenance period, any decline in the condition of plantings shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall engage professional arborists and/or horticulturalists to inspect plant materials and to identify problems and recommend corrective procedures. The Landscape Architect shall be immediately advised of such actions. Inspection and recommendation reports shall be submitted to the Landscape Architect.

3.6 PLANT ACCEPTANCE

- A. Upon completion of all planting work, the Contractor shall request in writing that the Landscape Architect formally inspect the planting work.
- B. If plant materials and workmanship are acceptable, the Landscape Architect will issue a written Certificate of Conditional Acceptance to the Contractor.
- C. Following the issuance of the Certificate of Conditional Acceptance to the Contractor, the Contractor shall maintain the plants for a minimum 30 day Monitoring Period. At the end of the Monitoring Period, the plant material will be inspected by the Landscape Architect to determine whether or not all planting work has been performed to the requirements of this Section 02900, LANDSCAPING.
- D. Acceptance Standards at end of the Monitoring Period: If plant material is reviewed when it is in full leaf, leaves shall be plump with water with a shape indicative of the species and shall be free of insect, pest and disease damage. Twigs shall have living cambium for their full length. Twigs and branches shall have a full bud set for their full length, including terminal buds. Trunks and branches shall be free of frost cracks; sun scald; damage due to insects, pests, and disease; structural defects; and damage resulting from machinery or tools. Plant material inspected and reviewed when the plants are not in full leaf shall have twigs, branches and trunks meeting the above requirements. All plants regardless of the season of review shall have a minimum of 75 percent healthy, balanced branching structure with a healthy terminal leader(s) with viable terminal bud(s).
- E. If any numbers of plants do not meet these Acceptance Standards at the time of inspection, or if in the Landscape Architect's opinion, workmanship is unacceptable, written notice will be given by the Landscape Architect to the Contractor in the form of a punch list, which itemizes necessary planting replacements and/or other deficiencies to be remedied. The Contractor's responsibility for maintenance of all plants shall be extended until replacements are made or other deficiencies are corrected. All plants that do not meet these Acceptance Standards shall be removed from the project within seven days of receipt of the punch list. Replacements shall conform in all respects to the Specifications for new plants and shall be planted in the same manner

- F. Following the correction of all Punch List deficiencies, the Contractor shall request in writing that the Landscape Architect formally inspect the planting work. If plant materials and workmanship are acceptable, the Landscape Architect will issue a written Certificate of Final Acceptance to the Contractor.

3.8 PLANT GUARANTEE

- A. The date of the Certificate of Final Acceptance shall establish the beginning of the maintenance period and the commencement of:
 - 1. The required **one-year guarantee** and establishment period for perennial planting work; and
 - 2. The required **two-year guarantee** and establishment period for tree planting work
- B. At the end of each guarantee and establishment period, a final inspection will be held to determine whether any plant material replacements are required. Each plant shall be plumb, shall have a character that is natural for its species as determined by the Landscape Architect, and shall conform to the Acceptance Standards described in this Section 02900, LANDSCAPING. Plants found to be unacceptable shall be removed promptly from the site and replaced according to this Section 02900, LANDSCAPING. A final inspection will be made after the replacement plants have lived through one year.
- C. At the end of the **two-year guarantee** and establishment period for tree planting work, remove all tree stakes, guys, or anchors installed on trees during the course of the work of this contract.

3.9 CLEAN-UP

- A. Remove soil or similar material which has been brought onto paved areas, keeping these areas clean. Upon completion of planting, remove excess soil, stones and debris which has not previously been cleaned up and legally dispose of off-site.

PART 4 – COMPENSATION

2900.1

PLANTING AREAS

LUMP SUM

METHOD OF MEASUREMENT:

Measurement for payment for Planting Areas shall be made on a lump sum basis for each planting area as shown in these Contract Documents or as otherwise approved by the Engineer.

BASIS OF PAYMENT:

Payment for Planting Areas 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. The work includes but is not limited to: furnishing

planting soil; preparation of planting soil; furnishing, placing and planting trees, shrubs, and containerized plants; seeding; mulching; staking trees; applying fertilizer, lime and mycorrhizael inoculants; watering; replacement and protection of planted areas during the establishment period and plant guarantee.

EXCLUSIONS AND SPECIAL NOTES:

Payment for Street Tree pits (trees planted outside the boundary of the plaza) shall not be paid for under this item and are paid for elsewhere.

END OF SECTION 02900

SECTION 02901

PLANTING SOILS

2901.1	SAND BASED STRUCTURAL SOIL	CUBIC YARD
2901.2	PLANTING SOIL	CUBIC YARD
2901.3	HORTICULTURAL SUBSOIL	CUBIC YARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, including GENERAL AND SUPPLEMENTARY CONDITIONS and GENERAL REQUIREMENTS, apply to the work of this Section and are hereby made a part of this Section.
- B. Examine all Drawings and other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SCOPE OF WORK

- A. This Section specifies administrative and procedural requirements for manufactured planting soils (planting soils) including, but not limited, to the following:
 - 1. Subgrade preparations.
 - 2. Planting soil material acquisition.
 - 3. Testing and analysis for specification conformance.
 - 4. Installation of drainage lines and drainage layer below planting soils.
 - 5. Preparation of mixes and testing for conformance.
 - 6. Mock Up.
 - 7. Installation and placement of soils.
 - 8. De-compaction and re-compaction of soils.
 - 9. Final in-place testing of soils.
 - 10. Coordination with other contractors.
 - 11. Clean-up.
- B. References to other Sections are given that would duplicate provisions in this Section.

1.3 RELATED WORK UNDER OTHER SECTIONS

- A. Division 02500 – Earthwork
- B. Section 02780 – Precast Concrete Pavers
- C. Section 02810 – Irrigation

D. Section 02900 – Landscaping

1.4 QUALITY ASSURANCE/DEFINITIONS

A. Definitions:

1. Refer to Section 02900 – Planting.
2. ASA: American Society of Agronomy.
3. Soil Scientist: The project Soil Scientist shall be Pine and Swallow Environmental, 867 Boston Rd., Groton, MA 01450, 978-448-9511, www.pineandswallow.com
4. Subgrade: Soil material and levels resulting from the approved rough grading work.
5. Drainage Layer/Drainage Blanket: A layer of specified sand/sand and gravel to facilitate drainage and control of groundwater below planting soils.
6. Planting Soils: Planting Soils are composed of a blend of three base components: base loam, organic material and sand. The quality of the blend depends on the quality of the original components. Locate and obtain approval of sources for base loam, organic material and sand that meet the Specification requirements. Contractor is then responsible for mixing the components. Approximate mixing ratios are provided, but may require adjustment, depending on the final materials and with the approval of the Architect or their representative, in order to meet Specification requirements for each blend.

B. Testing/Testing Agency

1. Refer to Division 31 Earthwork.
2. Refer to Section 329300 Trees, Plants and Ground Covers
3. Refer to this section, 1.5 B.

C. Contractor is solely responsible for quality control of the Work.

D. The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the Work, including the preparation, mixing and installation of custom Planting Soil and planting mixes in urban locations.

1. The installing Contractor shall be the same firm that is installing planting as described in Section 02900 – Planting
2. Installer Field Supervision: Installer to maintain an experienced full-time supervisor on Project site when any Planting Soil preparation work is in progress.
3. The installer's crew shall be experienced in the installation of soil, grading and interpretation of grading plans in urban areas.

E. Soil work shall be performed by a firm that has sufficient earthwork machinery at the job site simultaneously to amply provide for the vigorous execution of the site work without interruption or delay, except for unforeseen circumstances, such as weather. Machinery operators shall be well experienced in this type of work.

- F. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.
- G. Comply with all requirements for control of silt and sediment during soil installation work as indicated in the contract documents. Provide additional silt and sediment control to maintain silt and sediments within the working area as required by the progress of the work or as directed by the Landscape Architect and Soil Scientist.
- H. Pre-installation Conference: Conduct conference at project site prior to the start of any work related to Planting Soil preparation and shall meet the requirements of this Section 3.1(D).
- I. Layout and Grading:
 - 1. Permanent benchmarks shall be established by a registered land surveyor or professional civil engineer, at the Contractor's expense. The Contractor shall maintain established bounds and benchmarks and replace them, if any are destroyed or disturbed.
 - 2. The Contractor shall maintain at the site, sufficient surveying equipment to accurately excavate to the required subgrade and install soil to the required finish grade. The Contractor shall be responsible to install soil profiles at the elevations and thickness shown on the Plans.

1.5 TESTING, SUBMITTALS, MOCK-UPS AND INSPECTIONS

- A. Testing for Subgrade, Planting Soil Components and Planting Soil Mixes: Testing is required at the following intervals:
 - 1. Testing of individual components (Base Loam, Sand, and Compost) for planting soil mixes prior to blending of any soils for use at the Project Site. Tests are as described in this Section.
 - 2. After test results for components have been accepted, create sample Planting Soil Mixes of each planting soil mix and perform tests described in this Section.
 - 3. After the test results for each Planting Soil Mix have been accepted, and during the production of planting soils, test every 200 cubic yards of every Planting Soil Mix blended for: organic matter content, gradation, and pH. Before shipping of any Planting Soil Mix, the Contractor shall confirm that the Soil Scientist has accepted the mix. Testing applies to all soil layers of the planting profile. After three consecutive compliant tests, the Contractor may increase the interval of testing to 500 cubic yards.
 - 4. After horticultural tests have been approved, contractor shall submit representative samples of each soil blend to a geotechnical testing laboratory for ASAM 698 Standard Proctor tests to obtain optimum moisture content and maximum dry density values.

5. In-place tests: Compaction tests of each type of material (soil layer) placed shall be in accordance with this Section. Infiltration tests shall be in accordance with this Section.
6. Installation of Drainage Layer: Contractor shall notify Landscape Architect and Soil Scientist at least 5 days prior to the installation of drainage layers. Contractor shall demonstrate layout and installation of drainage lines and drainage layer. Sand Based Structural Soil or other Planting Soils shall not be installed until drainage layer is accepted.

B. Test Reports: Submit certified reports for tests as described in this Section.

1. Mechanical gradation (sieve analysis) shall be performed for sand, silt, and clay content and compared to the USDA Soil Classification System using sieve size numbers: 10, 18, 35, 60, 140 and 270. The silt and clay (0.002 mm) content shall be determined by a Hydrometer Test (ASTM D-422-63) of soil passing the #270 sieve.
2. Chemical analysis shall be undertaken for Phosphorus, Potassium, Calcium, Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, organic matter content, acidity (pH) and buffer pH.
3. 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. Tests include the following:
 - a. Test for soil Organic Matter by loss of weight on ignition, as described in Northeastern Regional Publication No. 493.
 - b. Test for soil CEC by exchangeable acidity method as described in Northeastern Regional Publication No. 493.
 - 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.
 - d. Test for Buffer pH by the SMP method as described in Northeastern Regional Publication No. 493.
 - e. Tests for pH shall be conducted on a 1:1 soil to distilled water ratio.
4. Certified reports on analyses from producers of composted organic materials shall be required and new test reports shall be submitted when compost sources are changed. Analyses shall include all tests for criteria specified in 2.1, K.
5. Saturated Hydraulic Conductivity: Test procedure ASTM D5856-95 (2000).
6. Testing Agencies: The following firms are acceptable testing agencies for the various components and blends.
 - a. Leaf Yard Waste Compost Comprehensive and Stability Test: Woods End Research Laboratory, P.O. Box 297, Mt. Vernon, ME,

04352, tel: 201.293.2457, fax: 201.293.2488 or alternate approved STA certified testing laboratory by the US Composting Council, www.compostcouncil.org.

- b. Mechanical Gradation, Chemical Analysis and Organic Matter Content, All Soil Components and Planting Soil Mixes: University of Massachusetts, 203 Paige Laboratory, 161 Holdsworth Way, Amherst, MA 01003, <http://soiltest.umass.edu>, tel: 413.545.2311, fax: 413.545.1931 or approved equal.
7. Laboratory Density Testing: ASTM D698 - 12 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
- a. Density tests shall be performed on samples collected at the Soil Supplier's facility, to obtain the optimum moisture content and maximum dry density values.

C. In-Place Testing

1. Density Tests: ASTM D6938-08a Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth). ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. (Standard Proctor).
 - a. In-place density tests shall be carried out at a rate of one test per each plant bed.
 - b. Soil density shall meet the requirements specified herein, see PART 3.
2. As required, in-place infiltration tests shall be performed using the equipment and methods described in Section 3 Execution.
3. At the direction of the Landscape Architect and Soil Scientist, in-place planting soil blends shall be sampled and tested by the Owner for compliance with gradation and organic matter content as specified herein. Non-compliant materials shall be removed from the site or amended as specified by the Soil Scientist.

D. Samples: Prior to ordering the below listed materials, submit representative composite samples to the Landscape Architect and Soil Scientist for selection and approval. Representative composite samples shall be composed of at least five equal-sized subsamples mixed thoroughly and resampled for submittal. Do not order materials until Landscape Architect's, and Soil Scientist's acceptance has been obtained. Delivered materials shall closely match the approved samples.

1. Components
 - a. Compost: duplicate samples of 1 gallon.
 - b. Base Loam: duplicate samples of 1 gallon.
 - c. Medium to Coarse Sand: duplicate samples 1 gallon.
2. Test Blends

- a. Planting Bed Soil: duplicate samples of 1 gallon
 - b. Sand-Based Structural Soil: duplicate samples of 1 gallon.
 - c. Horticultural Subsoil: duplicate samples of 1 gallon.
3. Production Stockpiles
- a. Planting Bed Soil: duplicate samples of 1 gallon
 - b. Sand-Based Structural Soil: duplicate samples of 1 gallon.
 - c. Horticultural Subsoil: duplicate samples of 1 gallon.
4. Materials
- a. 3/4" Crushed Stone: duplicate samples of 1 gallon
 - b. 3/8" Crushed Stone: duplicate samples of 1 gallon
 - c. Filter Fabric Mirafi 140N or equal: duplicate one square foot samples.
 - d. Perforated Aeration 4-inch pipe: duplicate one foot samples.
 - e. Nonperforated Aeration 4-inch pipe: duplicate one foot samples.
 - f. Underdrainage 4" corrugated Perforated Drain Pipe w/Filter Fabric: duplicate samples of 1 foot.
 - g. Underdrainage 4" Non-perforated Pipe: duplicate samples of 1 foot.
 - h. Triaxial Geogrid: duplicate samples of 1 foot
- E. Sources for Base Loam, Sand, and Compost: Submit information identifying sources for all soil components and the firm responsible for mixing of planting soil mixes.
- 1. Landscape Architect, Soil Scientist, and Owner shall have the right to reject any soil supplier or mixing facility.
 - 2. Soil mix supplier shall have a minimum of five years experience at supplying custom planting soil mixes.
 - 3. Submit supplier name, address, telephone and fax numbers and contact name.
 - 4. Submit certification that accepted supplier/ mixer is able to provide sufficient quantities and qualities of materials for the entire project.
 - 5. Final approval of soil supplier/ mixer shall be made after on-site review of supplier's and mixer's facility(ies) by the Soil Scientist.
 - 6. Recommended Soil Suppliers
 - a. Read Custom Soils, 5 Pond Park Road, Suite L, Hingham Massachusetts, 02042 781-828-6300, sales@readcustomsoils.com Contact: Mark Pendergast
 - b. D & H Loam, 2352 Main Street, Concord, Massachusetts, 978-897-4901, sales@dhloam.com Contact: Tom Dexter
 - c. New England Specialty Soils (N.E.S.S.), 435 Lancaster Street, Leominster, Mass, 978-230-2300, ed@nesoils.com ,Contact: Bob Doran
 - d. AgreSource Inc., 100 Main Street, Amesbury, MA 01913 Tel: 800-313-3320; Tel:978.388.5110, info@agresourceinc.com. Contact: Dave Harding

F. Subgrade Survey

1. Contractor shall submit for approval by the Landscape Architect a survey of final subgrade in all areas where planting soils will be placed. Placement of any drainage layer or planting soil shall not precede acceptance by the Landscape Architect.

G. Mock Up and Inspection

1. At the beginning of site work, the contractor shall demonstrate, in the presence of the Soil Scientist, subgrade preparations, including de-compaction and re-compaction methods and placement of sand blanket and drain lines that achieve the requirements of this Section. All subsequent subgrade preparations shall be in accordance with approved methods.
2. The Contractor shall not place Planting Soil, Sand Based Structural Soil or Horticultural Subsoil on prepared subgrade or drainage layer 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.
3. The Contractor shall not plant any plant material prior to inspection and approval of Landscape Architect and Soil Scientist for compliance with soil depth and compaction specifications. The Contractor shall request inspection before proceeding at least ten working days prior to placement of soils.
4. The Contractor shall construct a Mock Up of the initial installation of Sand Based Structural Soil in the presence of the Soil Scientist. The Mock Up may be part of the permanent installation if the Soil Scientist approves it. The Mock Up shall be conducted with the same equipment that will be used for the duration of the Sand Based Structural Soil installation. Mock Up must be conducted with material compliant with the soil moisture requirements provided in 1.6 H. A geotechnical testing agency shall be on site to conduct soil moisture and compaction/density tests for each lift installed during the Mock Up and subsequent soil placement.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 31 Earthwork for overall material handling requirements.
- B. In addition, the following provision is established: Material shall not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall, early spring or if frozen. Soil shall be handled only when the moisture content is compliant with Section 02901 1.6.H. The Landscape Architect, the Soil Scientist and the Owner shall be consulted to determine if the soil is too wet to handle.
- C. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage,

injury and theft.

- D. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from Construction Manager. Deliver materials only after preparations for placement of planting soil have been completed.
- E. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.
- F. Planting 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.
- G. Vehicular access to the site is restricted. Before construction, the Contractor shall submit for approval a plan showing proposed routing for deliveries and site access.
- H. Soil Moisture Content
 - 1. Contractor shall not move, blend or grade soil when moisture content is so great that free moisture is apparent, nor when it is so dry that dust will form in the air or that clods will not break readily, nor when it is frozen. Apply water, if necessary, or allow to dry to bring soil moisture between 60% of optimum moisture content and optimum moisture content as determined by ASTM D698 prior to compaction, grading or planting.
 - a. Sand Based Structural Soil must be tested, and be compliant for soil moisture content immediately prior to delivery or placement at the site.
 - b. Sand Based Structural Soil should be as close to optimum moisture content as possible for best results during compaction.
 - 2. Field Soil Moisture Test procedure is applicable for general soil moving and placement only and shall not be considered appropriate for compaction of soils, nor is a replacement for the above testing procedure.
 - a. Form soil in palm of hand, if soil retains shape and crumbles upon touching, the soil may be worked.
 - b. If the soil will not retain shape it is too dry and should not be worked.
 - c. If the soil retains shape and will not crumble, it is too wet and should not be worked.
 - d. If the soil glistens or free water is observed when the sample is patted in the palm of hand the soil is too wet and should not be worked.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General

1. All plant mix material shall be imported and fulfill the requirements as specified and be tested to confirm the specified characteristics.
2. 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.
 - a. No base component material or soil components for soil mixes shall be used until certified test reports by an approved soil testing laboratory and have been received and approved by the Landscape Architect and Soil Scientist.
 - b. As necessary, make any and all soil mix amendments and resubmit test reports indicating amendments until approved.
3. The Landscape Architect and Soil Scientist may request additional testing by Contractor for confirmation of mix quality and/or soil mix amendments at any time until completion. Changes in mix ratios may be required.

B. Soil Testing and Soils Testing Report Submittal

1. All testing of the soil mix components shall be carried out by the Soils Testing Laboratory. Recommendations for amending and/or correcting the soil mix will be provided to the Contractor by the Soil Scientist after approval by the Landscape Architect and Soil Scientist.
2. Failure of any material by testing and/or amendment procedure to meet Specification requirements shall require the Contractor to seek another source for the failed material and the initiation of all testing procedures for the new replacement material shall immediately take place.
3. The Contractor shall be responsible for recognizing that these critical project materials warrant timely and serious attention, that the testing process to achieve Approved materials should be considered a lead time item, and that under no circumstance shall failure to comply with all specification requirements be an excuse for “staying on project construction schedule.”
4. Refer to the “Planting Soil Testing Protocol”, located in the Appendix of this Specification.

- C. Soil Samples: Contractor is responsible for paying costs for testing. Submit 1 gallon planting soil samples in two phases. Submit samples concurrent with horticultural soil test reports in both phases. Submit as phase one, planting soil base components for approval. Only after approval of phase one components, submit as phase two, soil blend mixes / mediums for approval. All reports must be from recent analyses, less than 90 days old, and represent materials that are

available for delivery to the site.

1. Phase One Submittals of Planting Soil Base Components:
 - a. Base Loam (Imported Topsoil)
 - b. Organic Amendment Materials (Compost)
 - c. Coarse Sand for Amending Soil
 - d. Crushed Stone for Use Over Sand Based Structural Planting Soil
2. Phase Two Submittals of Planting Mediums: mixing and batching of soil mediums to be submitted in the same manner as bulk soils and will be prepared prior to delivery to site.
 - a. Horticultural Subsoil
 - b. Planting Bed Soil
 - c. Sand Based Structural Planting Soil
3. Phase Three Submittals shall be identical to Phase Two Submittals and be conducted for each 500 cubic yards of soil material prepared for the project site.
4. Submit reports for each of the above samples: Submit sample from each proposed source for testing and approval. Deliver samples to both the testing laboratory and the project soil scientist and pay costs. Send report directly to Owner's Representative.
5. Soil Sample Submittals: Sampling shall be done by the Contractor. The size of the samples and method of sampling shall be as follows: Samples shall be representative of the material to be brought to the site. Each sample shall be a Composite Sample, which consists of 5 separate sub samples taken from a minimum of (5) different locations at each source and mixed together to make the test sample.
6. The Contractor shall schedule this testing in order to permit reasonable time for testing, evaluation, and approvals prior to scheduled installation. Allow for a minimum of 4 weeks to perform testing and obtain approvals.

D. Imported Base Loam

1. Imported Base Loam, as required for blending with sand and compost, shall be a naturally occurring A-Horizon soil formed from geologic soil forming processes without admixtures of sand or organic matter sources (composts). Base Loam, which has been contaminated by incorporation of subsoil, shall not be acceptable for use. 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

2. The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 8 or less ($D80/D30 < 8$).
3. 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.
4. The organic content shall be between 4.0 and 8.0 percent by weight.
5. pH shall be between 5.8 and 7.0.
6. Chemical analysis shall be undertaken for Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

E. Medium to Coarse Sand

1. Sand for Planting Soil Blends, protection of filter fabric and for drainage as required, shall be uniformly graded medium to 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 grain size distribution for material passing the #10 sieve:

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

2. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.

3. The ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 2.8 or less ($D70/D20 < 2.8$). Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.
4. pH shall be less than 7.5.

F. Alternate Sand Layer Drainage Material

1. Sand for Drainage shall meet the requirements of Coarse Sand above, or Alternate Sand Drainage Material may be substituted, provided it meets the Specification ranges below, and is submitted and accepted by the Soil Scientist and Landscape Architect.
2. Free-draining sand and gravel borrow shall consist of inert, hard, durable stone and coarse sand, free from loam, clay, mica, surface coatings and deleterious materials and shall conform with the following gradation:

<u>U.S. Sieve No.</u>	<u>% Passing by Weight</u>	
	Minimum	Maximum
3 inch	100	-
1/2 inch	60	-
# 4	40	100
# 50	8	28
# 200	0	5

3. Sand and gravel borrow shall be placed in lifts not more than nine inches thick before compaction. Compaction shall be by vibration to a density between 90 and 95% Standard Proctor. Saturated hydraulic conductivity of the sand and gravel shall be not less than 15 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 95% Standard Proctor, ASTM 698.

G. Organic Amendment (Compost)

1. 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.
- 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. 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.
- d. pH: The pH shall be between 6.5 to 7.4 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter American Society of Agronomy Methods of Soil Analysis.
- e. Salinity: Electrical conductivity of a one to five soil to water ratio extract shall not exceed 2.5 mmhos/cm (dS/m).
- f. 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.
- g. Nutrient content shall be determined by the Testing 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.

H. 3/8" Crushed Stone for use over Sand Based Structural Planting Soil

- 1. Crushed stone (3/8 inch) shall consist of durable double washed crushed rock consisting of the angular fragments obtained by breaking and crushing solid or shattered rock and free from a detrimental quantity of thin, flat or elongated or other objectionable pieces. Crushed stone shall be reasonably free from clay, loam or deleterious material and shall conform to the following gradation (Massachusetts Highway Specification M2.01.6.)

U.S. Sieve Size Number	Percent Passing	
	Minimum	Maximum
1/2 inch	100	-
3/8inch	85	100
#4 Sieve	10	30
#8 Sieve	0	15
#16 Sieve	0	5

I. 3/4" Crushed Stone for use over Sand Based Structural Planting Soil

1. Crushed stone (3/4 inch) shall consist of durable crushed rock consisting of the angular fragments obtained by breaking and crushing solid or shattered rock and free from a detrimental quantity of thin, flat or elongated or other objectionable pieces. Crushed stone shall be reasonably free from clay, loam or deleterious material and shall conform to the following gradation.

<u>U.S. Sieve No.</u>	<u>% Passing by Weight</u>	
	Minimum	Maximum
1 inch	100	-
3/4inch	90	100
1/2 inch	10	50
3/8 inch	0	20
# 4 Sieve	0	5

J. Filter Fabric, as required, shall be Mirafi 140N or approved equivalent.

K. Underdrainage Pipe with Filter Fabric

1. Planting underdrain pipe shall be Fabric Wrapped 4 inch ADS Perforated Single Wall Corrugated Polyethylene Pipe, manufactured by ADS Company, Columbus, OH 43221, or approved equal. Pipe shall be manufacturer's standard perforated configuration. Fabric wrap shall be installed by the manufacturer, and shall be free of defects or damage. Jointing shall be made using manufacturer's standard snap coupling type fittings.

K. Perforated Aeration Pipe

1. Aeration pipe shall be 4 inch ADS Perforated Single Wall Corrugated Polyethylene Pipe, manufactured by ADS Company, Columbus, OH 43221, or approved equal. Pipe shall be manufacturer's standard perforated configuration. Jointing shall be made using manufacturer's standard snap coupling type fittings.

L. Non-perforated Pipe

1. Pipe shall be 4" ADS Single Wall Corrugated Polyethylene Pipe, manufactured by ADS Company, Columbus, OH 43221, or approved equal. Pipe shall be manufacturer's standard non-perforated configuration. Jointing shall be made using manufacturer's standard snap coupling type fittings.

M. Triaxial Geogrid

1. Triaxial Geogrid shall be shall be TX 140 manufactured by Tensar International Corporation, 5883 Glenridge Drive, Suite 200, Atlanta, GA 30328-5363, tel: 800 836 7271, www.tensarcorp.com.

2. Geogrid shall be installed on a plane within the crushed stone layer at sand based structural soil installations beneath permeable pavers at locations shown on the Plans.

2.2 PLANTING SOIL MIXES

- A. All existing vegetation shall be removed from stockpiles prior to blending. Uniformly mix ingredients by windrowing/tilling on an approved hard surface area or by alternately processing materials through a screening plant. All soil components and Organic Amendment shall be maintained moist, not wet, during mixing. Amendments shall not be added unless approved to extent and quantity by the owner and additional tests have been conducted to verify type and quantity of amendment is acceptable. Percentages of components are approximate and will be verified upon completion of individual test results for components of the various mixes. Due to variability of soil materials, mix ratios may require adjustment and re-submittal at the expense of the Contractor.
- B. After component percentages are determined by the Soil Scientist, each planting soil mix shall be tested for physical and chemical analysis. Component percentages may be modified at any time by the soil scientist dependent upon the results of testing of the various components or final blends.

C. Sand Based Structural Soil

1. Base Loam, Sand and Compost, each as specified above, shall be combined in an approximate mix ratio of four parts by volume Sand to one part by volume Imported Base Loam to one and one half part by volume Compost (4S:1L:1.5C) to create a uniform blend which meets the following requirements.
2. Gradation for Material Passing the Number 10 Sieve:

U.S. Sieve Size Number	% Passing by Weight	
	Minimum	Maximum
10	100	-
18	68	90
35	38	63
60	18	39
140	9	18
270	8	10
0.002mm	1	2

3. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 15% by weight of the total sample.
4. Ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 3.2 or less. ($D70/D20 < 3.2$)
5. Saturated hydraulic conductivity of the mix: not less than 6 inches per hour, according to ASTM D5856-95 (2000) when compacted to a minimum of 92% Standard Proctor, ASTM 698.
6. Organic content: between 2.5 and 3.5 percent by weight.
7. The pH shall be between 6.0 and 6.5.

8. After approval of the above horticultural testing, conduct Standard Proctor Test (ASTM 698) to obtain maximum dry density and optimum moisture content values.

D. Planting Bed Soil

1. Planting Bed Soil shall consist of a combination of approximately equal parts by volume Stripped Existing or Imported Base Loam, Coarse Sand and Organic Amendment/Compost (1L:1S:1C) to create a uniform blend which meets the following requirements.
2. 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	85	95
35	60	85
60	42	65
140	21	44
270	18	24
0.002 mm	2	4

3. Maximum size shall be one half-inch largest dimension. The maximum retained on the #10 sieve shall be 10% by weight of the total sample.
4. The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 6 or less ($D80/D30 < 6$).
5. The final mix shall have an organic content between 5 and 7 percent by weight.
6. The final mix shall have a hydraulic conductivity of not less than 1.5 inches per hour according to test procedure ASTM D5856-95 (2000) when compacted to a minimum of 86 percent Standard Proctor ASTM D 698. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.
7. Chemical analysis shall be undertaken for Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.
8. pH shall be between 6.0 and 6.8

E. Horticultural Subsoil

1. Horticultural Subsoil for the lower layer of planting soil in Planting Beds shall consist of a combination of approximately 2 parts by volume Coarse Sand to one part by volume Stripped Existing or Imported Base Loam to one half part by volume Compost (2S:1L:0.5C). Sand Based Structural Soil blend may be substituted for Horticultural Subsoil if approved by the Soil Scientist.
2. Gradation for material passing the #10 sieve:

U.S. Sieve Size No.	Minimum	Maximum
10	100	--
18	85	95
35	55	80
60	30	60
140	18	33
270	12	16
0.002mm	1	3

3. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.
4. Ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 6.0 or less ($D_{80}/D_{30} < 6.0$).
5. 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.
6. Organic content: between 1.5 and 3.0 percent by weight.
7. pH shall be between 6.0 and 6.8

PART 3 – EXECUTION

3.1 PRE-INSTALLATION EXAMINATION AND PREPARATION

- A. Reference Other Sections as necessary.
- B. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.
- C. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify Landscape Architect and Soil Scientist in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by the Landscape Architect and Soil Scientist.
- D. Kickoff Meeting: At least 10 working days prior to the start of work, the contractor shall request a landscape construction kickoff meeting with the owners representative, landscape architect, soil scientist and any other parties involved with landscape construction. The contractor must demonstrate familiarity with this Section 02901 Planting Soils, and other relevant sections of the construction documents. The contractor shall articulate the means and methods of soil blending, subgrade preparation, soil placement and other steps outlined in the Specification.
- E. Examination of Subgrade: The subgrade shall be examined by the Contractor prior to the start of subgrade preparation, soil placement and planting. Any deficiencies shall be noted and related to the Landscape Architect and Soil Scientist in writing prior to acceptance of the subgrade by the Landscape Contractor. Deficiencies include, but shall not be limited to the following:
 - 1. Construction debris present within the planting areas.
 - 2. The subgrade is at incorrect depths for installing the designed soil profile and drainage layer.
 - 3. Incomplete irrigation and/or subsurface drainage installation.
 - 4. Incomplete lighting and exterior electrical installation.
 - 5. Conflict with underground utilities.
 - 6. Subgrade contaminated with oils, compressible material, silt or clay
 - 7. Subgrade without drainage layer must infiltrate water at the rate of at least one inch per hour.
- F. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.
 - 1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace slopes where required and maintain

- sides of slopes of excavations in safe condition until completion of backfilling. Provide protection measures as required for public safety.
2. All subgrade areas to be filled with Drainage Layer or Planting Soil shall be free of construction debris, refuse, vegetation, compressible or decayable materials, all stones greater than 6 inches, concrete washout or soil crusting films of silt or clay that reduces or stops drainage from the Planting Soils into the subsoil; and/or standing water. Such material shall be removed from the site.
 3. The subgrade must slope at a minimum of two percent towards the bottom of slopes and subdrains. Subgrade levels shall be adjusted as required to ensure that all planting areas have adequate drainage.
- G. Do not proceed with the installation of Drainage Layer or Planting Soils until all utility work in the area has been installed.
1. The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.
- H. Planting Soil Preparation: Refer to Section 02901, 2.2 for planting soil and mixtures. Examine soil and remove foreign materials, stones and organic debris over 1/2" in size. Remove all vegetation from stockpiles prior to blending. Mix-in fertilizers and amendments as required by tests and as approved by the Landscape Architect and Soil Scientist. All preparation and mixing shall be accomplished when the soil moisture content is compliant with Section 02901, 1.6.H and at a moisture content approved by the Landscape Architect and Soil Scientist. If lime is to be added, it shall be mixed with dry soil before fertilizer is added and mixed.

3.2 EXCAVATION AND REMOVAL

- A. Refer to Earthwork Division

3.3 MIXING OF PLANTING SOIL MIXES

- A. Soil blends shall be produced with equipment that blends together each component in a thorough and uniform manner. This may be accomplished by a minimum of three handling events on a hard surfaced area with earth moving equipment or by alternately passing soil components through a screener.
- B. Base components and Soil Mix stockpiles should be protected from wind and rain and shall not be permitted to be stored in standing water.
- C. Planting Soil and Sand Based Structural Soil shall be protected from precipitation until soil placement is completed.

3.4 WORKING AROUND UTILITIES

- A. Carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.

- B. Known underground and surface utility lines are indicated on the utilities drawings – See Civil and Architect’s plans. Contact the local Dig Safe organization and give them their required time to respond and mark the property. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.
- C. Perform work in a manner that will protect utilities from damage. Hand excavate as required and provide adequate means of support and protection of utilities during soil installation operations. Maintain grade stakes set by others until parties concerned mutually agree upon removal. The Contractor shall repair all utilities damaged by soil operations at the Contractor’s expense.

3.5 SUBGRADE PREPARATION, INSPECTION AND PERCOLATION TESTING

- A. In areas with no drainage layer, after subgrade levels have been reached, the Landscape Architect or Soil Scientist shall observe de-compaction and preparation of the subgrade according to this Section and inspect soil conditions to evaluate subsurface drainage conditions.
- B. Coordinate the following scarification work to eliminate subgrade compaction when located in planting areas without a drainage layer. Maintain 12” clearance from any underground utilities during subgrade de-compaction.
 - 1. Heavy Site Subgrade Compaction Mitigation:
 - a. Heavily compacted subgrade areas such as, but not limited to, temporary parking areas, material stockpile areas, temporary roadways, construction areas and areas around structures and other similar areas.
 - b. Prior to establishing the final subgrade, these areas shall be dug up or ripped to a depth of (18) inches to break up the soil hard pan, then re-compacted with two passes of the tracks of a wide track bulldozer size D-6 or smaller, or other approved equipment. Vibratory compaction of subgrade in planted areas is prohibited.
 - 2. General Site Subgrade Compaction Mitigation for all planting areas in fills or that are not heavily compacted and would be mitigated as specified in Item 1 above:
 - a. Immediately prior to placing drainage layer or Planting Soil, the entire subgrade shall be loosened to a minimum depth of 8-inches using the teeth of a backhoe or other suitable equipment, then re-compacted with the curled bucket of an excavator, or other approved equipment. Vibratory compaction of subgrade in planted areas is prohibited.

- C. After Subgrade has been scarified as described above, it shall be recompressed by using the tracks of a wide-tracked bulldozer, multiple passes of a skid steer loader, or the curled bucket of an excavator. In areas of subgrade with no drainage layer, verify the subgrade passes water at or greater than the minimum requirement.
- D. Remove all stones or debris greater than 6" in any dimension from the subgrade prior to placing Drainage Layer or Planting Soils.
- E. After the subgrade has been prepared, in areas with no drainage layer, Percolation Tests shall be performed according to the following test procedures.
 - 1. Utilize perforated canisters or buckets seven to ten inches in diameter and a minimum of six inches high.
 - 2. 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.
 - 3. 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. Tamp the coarse sand to firmly fill any void space around the test canister.
 - 4. 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.
 - 5. 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 percolation for a minimum of one hour or until the water level has dropped a minimum of three inches after the start of measurements.

3.6 INSTALLATION OF DRAINAGE LAYER

- A. Drainage Layer
 - 1. After subgrade preparation, layout drainage lines as shown on the plans. Excavate subgrade to achieve a minimum slope of 3% toward drain lines. Drain lines must slope downward at a minimum of 0.5 percent, with 1 percent or greater preferred.
 - 2. Use manufacturer snap type fittings for all drain line connections.
 - 3. After layout and inspection of drain lines, place drainage sand layer over drain lines in areas and in thicknesses depicted on the plans.
 - 4. In areas with no drainage layer, drain piping must be surrounded by a minimum of 2 inches of sand for protection of filter fabric.
 - 5. Notify Landscape Architect and Soil Scientist and obtain acceptance of drainage layer prior to installation of planting soils.
 - 6. In areas with Sand Based Structural Soil, the drainage layer shall be vibratory compacted with two passes of a plate compactor.

3.7 BACKFILLING OF HORTICULTURAL SOIL LAYERS

A. Soil Placement Preparation:

1. Verify that the plumbing for the irrigation system has been installed and accepted.
2. Verify that the subgrade preparations have been reviewed and accepted, including de-compaction and removal of large stones.
3. Notify the Landscape Architect and Soil Scientist of soil placement operations at least seven calendar days prior to the beginning of work.
4. In areas with no drainage layer, verify that the subgrade passes the minimum water infiltration requirement.
5. Do not proceed with the installation of Planting Soils, until all utility work in the area has been installed.
6. The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.
7. Do not begin Planting Soil installation until all drainage, irrigation main lines, lateral lines, subgrade preparations and irrigation risers shown on the drawings are viewed and approved by the Landscape Architect and Soil Scientist.
8. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use plywood and/or plastic sheeting as directed to cover existing asphalt, concrete, metal and masonry work.
 - a. Clean up any soil or dirt spilled on any paved surface, including at the end of each working day.
 - b. Any damage to the paving or architectural work shall be repaired by the Contractor at the Contractor's expense.

B. After the subgrade soils have been loosened, re-compressed and inspected, and/or Drainage Layer has been approved, Planting Soils may be spread by using a wide track bulldozer size D-5 or smaller or may be dumped and 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.

C. Placement of Planting Bed Soil, Sand Based Structural Soil and Horticultural Subsoil:

1. Placement of Planting Bed Soil and plant stock shall be carried out simultaneously to prevent excessive traffic over soil lifts and to maintain the integrity of the soil layers. The contractor shall install plants simultaneously with the installation of the lower soil layers. The upper soil layers shall not be installed before all plants are installed and before the acceptance by the Landscape Architect and Soil Scientist.
 - a. After subgrade preparation and approval, in areas of tree and shrub planting with rootballs 12" in diameter or greater, crate a transition

- layer and place and compact Horticultural Subsoil (SBSS) as described in this Section.
- b. After inspection and approval of Horticultural Subsoil, place trees and shrubs in locations shown on the plans and at the proper elevations.
 - c. Create a transition layer as described in this Section. Place and compact Planting Bed Soil around trees and shrubs as described in this Section.
2. To simplify construction of the soil profiles, Sand Based Structural Soil (SBSS) may be substituted for horticultural subsoil for the lower layer of soil in planted areas. Sand Based Structural Soil should only be vibratory compacted at areas beneath sidewalks. Sand Based Structural Soil for use as horticultural subsoil shall not be vibratory compacted.
 3. Planting Bed Soil, Sand Based Structural Soil, Horticultural Subsoil shall be placed in lifts not to exceed 8 inches in thickness and compacted to meet minimum and maximum requirements as specified below:
 - a. A transition zone shall be formed between the prepared subgrade, drainage layer, Sand Based Structural Soil and Planting Bed Soils by placing one inch of the upper-layer soil and raking into the lower soil to a two-inch thickness.
 - b. Horticultural Subsoil (or SBSS in Planted Areas) shall be compacted to between 84 and 87 percent Standard Proctor, except soils beneath the rootballs shall be compacted to between 87 and 90 percent Standard Proctor to create a firm pedestal and prevent settlement of the rootballs.
 - c. Planting Bed Soil and Horticultural Subsoil shall be compacted to between 82 and 85 percent Standard Proctor.
 - d. Planting Soils shall not be compacted with vibratory equipment. Sand Based Structural Soil below structures must be compacted with vibratory equipment provided the moisture content is compliant with Section 02901 1.6H.
 4. Sand-Based Structural Soil shall be spread in lifts not greater than eight inches and compacted with a minimum of three passes of vibratory compaction equipment to a density between 92 and 96 percent Standard Proctor Maximum Dry Density. Notify Soil Scientist if more than 8 passes are required to achieve minimum density requirement.
 - a. Prepare Mock-Up of initial Sand Based Structural Soil Installation as provided in this Specification. After approval of the Mock Up, all subsequent installation of Sand Based Structural Soil shall be placed according to approved methods.
 - b. A medium to large sized vibratory plate compactor should be used to compact Sand Based Structural Soil. Moisture content of Sand Based Structural Soil should be as close to optimum moisture content (as determined by Standard Proctor Test) as possible for best results.

- c. Rake the surface of each accepted lift of Sand Based Structural Soil to break the surface glaze caused by the compaction equipment, prior to placing subsequent lifts.
 - d. Density testing for Sand Based Structural Soil must be ASTM D6938-10 Nuclear Methods, after ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. Density testing shall be conducted at a minimum of one test for each plant bed for each lift. Geotechnical testing agency must be on-site to conduct soil moisture and density tests during installation of Sand Based Structural Soil.
 - e. Sand-Based Structural Planting Medium shall be placed in 8” lifts to a minimum depth of two feet within the areas shown on the Drawings, except as otherwise indicated. A minimum of eight inches of 3/4 inch crushed stone shall be placed over the Sand-Based Structural Planting Medium in areas shown on the Plans.
 - f. Tri-Axial Geogrid shall be placed over the rootballs and extend to the limits of Sand Based Structural Soil at the locations and elevations shown on the plans. Tri-Axial Geogrid shall be installed as a plane, free from wrinkles or surface imperfections.
 - g. A filter fabric irrigation dispersion strip and aeration and irrigation lines shall be installed at the bottom of crushed stone layer at the locations shown on the plans.
4. In all cases, the soil being placed shall be in a dry to damp condition. No wet soils shall be placed. Soil moisture content must be compliant with Section 02901 1.6.H prior to compaction. All testing of in-place density for planting materials shall be made by the soil scientist or according to ASTM D6938-10 Nuclear Methods after conducting ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
- a. Sand Based Structural Soil must be tested for moisture content and compaction by ASTM Methods by an approved geotechnical testing firm at the time of installation.
5. Prevention of compacted soils can be accomplished by beginning the work in corner, against walls, or the center of isolated beds, and progressing outwards towards the borders.
6. Planting Soils shall never be moved or worked when wet or frozen.
7. The Contractor shall place barricades or steel plates as required to prevent any unnecessary compaction of planting soil from vehicles, equipment, or pedestrian traffic.
8. After Planting Soils have been spread, it shall be carefully prepared by hand raking. Stones and debris over one inch in any direction shall be removed from the premises. Fine grade planting beds to a smooth even surface with loose uniformly fine texture. Remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas that can be planted immediately after grading. Maintain the finished surfaces at the grades shown and spread additional soil to correct

settlement or erosion. Surface drainage shall be maintained. Soil shall be damp and free from frost during fine grading operations.

3.7 PROTECTION

- A. The Contractor shall protect landscape work and materials from damage due to landscape operations, operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Treat, repair or replace damaged Planting Soil installation work immediately.
- B. Provide all means necessary, including fences, to protect all soil areas from compaction and contamination by trash, dust, debris, and any toxic material harmful to plants or humans after placement. Any area that becomes compacted, shall be de-compacted and tilled to the extent determined by the soil scientist and recompressed to the density ranges specified. Any uneven or settled areas shall be filled, re-graded and re-compacted to meet the requirements of this Specification. Soil that becomes contaminated shall be removed and replaced with specified soil material.
- C. Phase the installation of the planting soil blends such that equipment does not have to travel over already installed planting soil. Use of haul roads is acceptable provided that the haul road is completely re-worked to meet the requirements of this Specification.
- D. Apply filter fabric covering and planking or other engineering controls over soil to minimize compaction and collect dust and debris in any area where the Contractor must work after the installation of Planting Soil.
- E. Till compacted Planting Soil and replace Planting Soil that has become contaminated as determined by the Landscape Architect. Planting Soil shall be tilled or replaced by the Contractor at no expense to the Owner.

3.8 CLEAN-UP

- A. During installation, keep pavements clean and work area in an orderly condition.
- B. Keep the site free of trash and debris at all times. Immediately dispose of wrappings or waste materials associated with products necessary for the completion of the work.
- C. All trash and debris shall be kept in a central collection container. Do not bury trash and debris in back-fill.
- D. Once installation is complete, remove any excess soil from pavements or embedded in fixtures.

3.9 COORDINATION AND EXCESS MATERIALS

- A. Coordinate activities with other project contractors so that there is no soil

disturbance from traffic or other construction activities subsequent to placement.

- B. Excess Planting Soil Mixtures and Materials: Remove the excess planting soil mixture and materials from the site at no additional cost to the Owner unless otherwise requested.

3.10 POST-INSTALLATION TESTING

- A. In-place density testing is required in all areas. Placed and planting soils must be inspected for compaction level by the soil scientist or by the following acceptable Density Test Methods: ASTM D1556 Density of soil and rock in place using Sand Cone Method, ASTM D6938-10 Nuclear Methods, ASTM D2167-08 Rubber Balloon method, after ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
- B. Density testing for Sand Based Structural Soil must be by ASTM D6938-10 Nuclear Methods, after ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. Density testing shall be conducted at a minimum of one test for each lift in each plant bed or a minimum of every 300 square feet.
- C. Placed Planting Soils must be capable of infiltrating water at the minimum rate provided in this Specification for each type of planting soil

PART 4 - COMPENSATION

Item 2910.1 – Sand Based Structural Soil

METHOD OF MEASUREMENT:

Measurement for Sand-Based Structural Soil shall be based on the cubic yard installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Sand-Based Structural Soil shall be based on the cubic yard of Sand-Based Structural Soil as detailed in the Contract Documents installed complete for this item in the proposal. Under the cubic yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Sand-Based Structural Soil as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to: Soil Components, including Compost, Base Loam, and Medium to Coarse Sand; Test Blends of Sand-Based Structural Soil (SBSS); Production Stockpiles of Sand-Based Structural Soil (SBSS); 3/4" Crushed Stone; 3/8" Crushed Stone; 3/8" Rounded Peastone; Filter Fabric; Perforated Aeration 4-inch pipe; Nonperforated Aeration 4-inch pipe; Underdrainage 4" perforated pipe with Filter Fabric; Underdrainage 4" non-perforated pipe; and Triaxial Geogrid, required to complete the installation as indicated and specified; and all incidental work not included for payment elsewhere.

EXCLUSIONS:

The following items are not included for payment under this item: none

Item 2910.2 – Planting Soil

METHOD OF MEASUREMENT:

Measurement for Planting Soil shall be based on the cubic yard installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Planting Soil shall be based on the cubic yard of Planting Soil as detailed in the Contract Documents installed complete for this item in the proposal. Under the cubic yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Planting Soil as detailed and where indicated or required by the Owner or Engineer.

EXCLUSIONS:

The following items are not included for payment under this item: none

Item 2910.3 – Horticultural Subsoil

METHOD OF MEASUREMENT:

Measurement for Horticultural Subsoil shall be based on the cubic yard installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

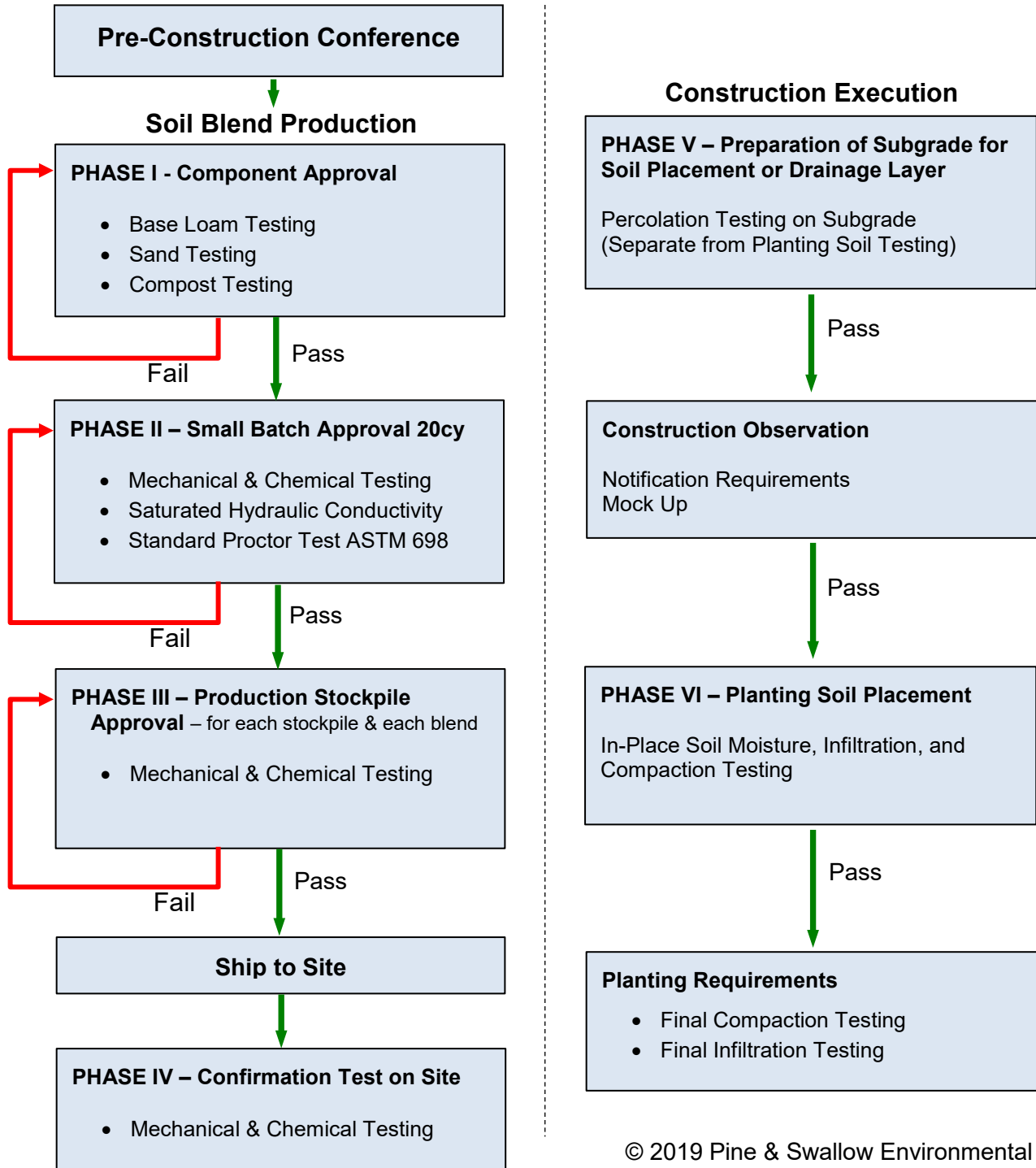
Payment for Horticultural Subsoil shall be based on the cubic yard of Horticultural Subsoil as detailed in the Contract Documents installed complete for this item in the proposal. Under the cubic yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the installation of Horticultural Subsoil as detailed and where indicated or required by the Owner or Engineer.

EXCLUSIONS:

The following items are not included for payment under this item: none

END OF SECTION 02901

APPENDIX: PLANTING SOIL TESTING PROTOCOL



SECTION 02950

BACK OF SIDEWALK RESTORATION

2950.1	HARDSCAPE BACK OF SIDEWALK RESTORATION	SQUARE YARD
2950.2	ASPHALT BACK OF SIDEWALK RESTORATION	SQUARE YARD
2950.3	LANDSCAPE BACK OF SIDEWALK RESTORATION	SQUARE YARD

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work covered under this Section includes the furnishing of all labor, equipment, appliances and materials, and in performing all operations in connection with restoration and reconstruction of back of sidewalk site features to their original condition and location including matching the original patterns of walkway and driveways such as herringbone, basket weave, running bond, etc. Back of Sidewalk material may consist of, but not limited to, brick, flagstone, concrete, gravel, cobble stone, wood, and limestone walkways and driveways, and all other necessary appurtenant work to reconstruct back of sidewalk areas to their original condition, as directed by the engineer, complete and accepted in accordance with the Drawings and Specifications and as required.

1.2 RELATED WORK

- A. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- B. Section 02500 – PAVING AND SURFACING
- C. Section 02524 – CURBS WALKS, AND DRIVEWAYS
- D. Section 02590 – BRICK MASONRY
- E. Section 02900 – LANDSCAPING

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 – SUBMITTALS.
- B. Certify, invoice, and order plants for each shipment grown, free of disease and insect pests. Submit certificates to Engineer.

PART 2 - MATERIALS

2.1 General

- A. Materials for all Non-Standard Back of Sidewalk Restoration shall be of the type, size, grade, and class to match the existing material and pattern as directed by the engineer.

PART 3 - EXECUTION:

- 3.1 All workmanship shall conform to the best standard practice, and all work shall be conducted by skilled workmen. The contractor shall repair/reconstruct all areas.
- 3.2 Landscape restoration shall be completed between April and October.
- 3.3 Refer to Section 02900- Landscaping for landscaping maintenance requirements.

PART 4 – COMPENSATION

Item 2950.1 – Hardscape Back of Sidewalk Restoration

METHOD OF MEASUREMENT:

Measurement for Hardscape Back of Sidewalk Restoration shall be based on the square yard installed, complete, within the payment limits, as shown on the Contract Drawings or as required by the Engineer.

BASIS OF PAYMENT / INCLUSIONS:

Payment for Hardscape Back of Sidewalk Restoration shall be based on the square yard of Hardscape Back of Sidewalk installed complete for this item in the proposal. Under the square yard price for this item, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the Restoration of all Hardscape Back of Sidewalk areas as detailed and where indicated or required by the Owner or Engineer. The work includes, but is not limited to; the furnishing of all labor, equipment, appliances and materials, and in performing all operations in connection with restoration and reconstruction of private property site features to their original condition and location including matching the original patterns of walkways and driveways such as herringbone, basket weave, running bond, etc. Back of Sidewalk material may consist of, but not limited to, brick, flagstone, cobble stone, concrete, wood, limestone, and gravel walkways and driveways, removing and resetting curbing, walls, stairs, as directed by the engineer and all other work not included for payment elsewhere.

SPECIAL NOTES ON INCLUSIONS/EXCLUSIONS:

The following items are not included for payment under this item; sidewalks, walkways, driveways and all other back of sidewalk areas installed to replace areas damaged by the Contractor during construction. Hot mix asphalt driveways and walkways within the right of way are not included for payment under this item and are paid for elsewhere. This item includes restoration of private property related to adjacent sidewalk and driveway restoration work within the right of way.

Contractor during construction. This item includes restoration of private property related to adjacent sidewalk and driveway restoration work within the right of way.

END OF SECTION 02950

SECTION 02980

SITE IMPROVEMENTS

2980.1	WARNING REGULATORY AND ROUTE MARKER – ALUMINUM PANEL (TYPE A)	SQUARE FOOT
2980.2	STREET NAME SIGN	EACH
2980.3	STEEL SIGN POST	EACH
2980.4	PARKING METER POST	EACH
2980.5	BUS SHELTER	EACH
2980.6	PLAZA MEMORIAL SIGN	EACH

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work of this Section consists of furnishing and installing all site improvements and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to, the following:

1. Warning Regulatory and Route Marker – Aluminum Panel (Type A)
2. Street Name Sign
3. Steel Sign Post
4. Parking Meter Post
5. Bus Shelter
6. Plaza Memorial Sign

1.2 RELATED WORK

- A. Section 02210, EARTH EXCAVATION, BACKFILL, FILL, AND GRADING
- B. Section 02500, PAVING AND SURFACING
- C. Section 02524, CURBS WALKS, AND DRIVEWAYS
- D. Section 03300, CONCRETE

1.3 REFERENCES

- A. Unless otherwise specified or indicated, materials and workmanship shall conform with the latest edition of the following standards, codes, specifications, requirements and regulations:
- B. Standard Specifications: The Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges, latest edition.
- C. American Society for Testing and Materials (ASTM):
 - A36 Structural Steel
 - A53 Pipe, Steel, Black and Hot-dipped, Zinc-coated
 - A120 Standard Galvanized Steel Pipe
 - A153 Zinc Coating (Hot-dip) on Iron and Steel Hardware
 - A386 Zinc Coating (Hot-dip) on Assembled Steel Products
 - A325 High Strength Bolts
 - B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - F626 Fence Fittings
 - F668 Polyvinyl Chloride Coated Steel Chain Link Fence Fabric
 - F900 Industrial and Commercial Swing Gates
 - F934 Standard Colors for Polymer Coated Chain Link Fence Materials
 - F1043 Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework
- D. American Steel and Iron Institute (ASI)
- E. American Welding Society (AWS):
 - D1.1 Structural Welding Code
- F. Steel Structures Painting Council (SSPC)
- G. American Welding Society (AWS):
 - D1.1 Structural Welding Code
- H. Steel Structures Painting Council (SSPC)

1.4 SUBMITTALS

- A. At least thirty (30) days prior to intended use, the Contractor shall provide the following submittals for approval.
- B. Shop Drawings, Manufacturer's Literature, and installation instructions for each item included within this specification section. Refer to Specification Section 01300-SUBMITTALS for submittal requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store work under this Section in a manner to prevent wracking or stress of components, and to prevent mechanical damage or damage by the elements.
- B. Items which become rusted or damaged because of non-compliance with these conditions will be rejected and shall be replaced without additional cost to the Owner.
- C. Deliver bolts and other small items required for erection of work under this Section bundled with their respective items.

1.6 GUARANTEE

- A. Furnish and deliver standard written manufacturer's guarantee in Owner's name covering all materials and workmanship under this Section, in addition to, and not in lieu of, guarantee requirements set forth under GENERAL CONDITIONS and SPECIAL PROVISIONS, and other liabilities which the Contractor may have by law or other provisions of the Contract Documents.
- B. Supplier shall guarantee, in writing, the satisfactory condition of the metal finish of his work in all parts for a period of twenty (20) years after date of final acceptance, and shall agree to promptly repair or replace any finish work which is found to be defective during this period.
- C. Supplier shall pay for repairs of any damage to any part of the project caused by defects in his work and for any repair to the materials or equipment caused by replacement. All repairs are to be done to the satisfaction of the Engineer.
- D. Any part of the work installed under this contract requiring excessive maintenance shall be considered as being defective and shall be replaced by the Supplier during the one-year period at no cost to the Owner.

PART 2 - PRODUCTS

2.1 REGULATORY SIGNAGE

- A. Signs shall be fabricated per Contract Document requirements and conform to MUTCD, latest edition, standards.
- B. The legend, border, and background of sign panels (except as modified below) shall be Type "C", permanently applied legend, or Type "D", silk screen processed, according to the requirements of Section M9.30.0 of the MassDOT Standard Specifications, Type III or Type IV.
- C. Legends and dimensions for City of Cambridge Standard Regulatory signs are included in the Appendix of these Specifications.

2.2 STREET NAME SIGN

- A. 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.

2.3 SIGN POST

- A. 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.

2.4 PARKING METER POST

- A. 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.

2.5 PEDESTRIAN BUS SHELTER

- A. The work shall consist of furnishing and installing a pedestrian bus shelter at the locations shown the Plans or as directed by the Engineer.
- B. Shelter - Shelter shall have a nominal 2’ x 12’ footprint, nominal manufactured by Daytech, Type: BBC04X12N “Avanti” Dome Roof, or approved equivalent product.
- C. 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.
- D. Shelter shall have aluminum extrusion framework with premium polyester powder cost finish in standard black.
- E. 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.
- F. The roof shall be an overhanging dome roof composed of aluminum roof ribs and ¼-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.
- G. 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.

- H. No interior lighting will be provided.
- I. 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.

2.6 PLAZA MEMORIAL SIGN

- A. Refer to Appendix G for Plaza Memorial Sign standard details and sign template.

PART 3 - EXECUTION

3.1 PERMANENT SIGNAGE AND PARKING METER POSTS

- A. 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 2980.3.
- B. The Contractor shall lay out the proposed locations of 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.

3.6 PEDESTRIAN BUS SHELTER

- A. 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.
- A. 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.
- B. 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.
- C. 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.

PART 4 - COMPENSATION

Item 2980.1 Warning Regulatory and Route Marker – Aluminum Panel (Type A)

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the area (in square feet) of each sign installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish and install signs.

Item 2980.2 Street Name Sign

Item 2980.3 Street Sign Post

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the actual number of each street name and sign post installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish and install street name signs and sign posts.

Item 2980.4 Parking Meter Post

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the actual number of each parking meter post installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish and install parking meter posts. No separate payment will be made for restoration of sidewalk areas which shall be considered incidental to the appropriate sidewalk item.

Item 2980.5 Bus Shelter

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on a lump sum basis complete in place as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price bid per each shall constitute full compensation for furnishing and installing the shelter, including excavation, coordination and

placement of required embedment in concrete sidewalk, and furnishing and installation of shelter including seating. This work shall also include modifications to landscaping adjacent to the pedestrian bus shelter to alter the path to Tobin Fields. This includes removal of the existing mulch area, furnishing and installing a new mulch area, removing and relocating a boulder, including all labor, equipment, materials, tools, incidental work. This work shall be completed as shown on contract drawings or as required by the engineer.

Item 2980.6 Plaza Memorial Sign

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the actual number of each Plaza Memorial Sign installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish and install Plaza Memorial Sign.

END OF SECTION 02980

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SECTION 02990
SITE FURNISHINGS

2990.1	STEEL BENCH	EACH
2990.2	6' WOOD LATTICE FENCE AND GATE	LINEAR FOOT
2990.3	BIKE RING (CITY STANDARD)	EACH
2990.4	BIKE RACK (PARABOLIC)	EACH
2990.5	SOLAR TRASH /RECYCLING COMBINATION	EACH
2990.6	TRASH RECEPTACLE – CITY STANDARD	EACH
2990.7	CUSTOM WOOD SLAT BENCH TOP; METAL FRAME, ARMRESTS, AND PERFORATED BACKS	LUMP SUM
2990.8	PUBLIC ART CONCRETE FOOTING	LUMP SUM
2990.81	PUBLIC ART INSTALLATION ASSISTANCE	LUMP SUM
2990.9	TRANSPORT + RESET MONUMENT OF MAYOR VELLUCCI	LUMP SUM
2990.11	METAL TABLE – WITH PERFORATED CHESS BOARD TOP (MOVEABLE)	EACH
2990.12	METAL CHAIR W ARMRESTS (MOVEABLE)	EACH
2990.13	METAL CHAIR WITHOUT ARMRESTS (MOVEABLE)	EACH
2990.14	COMMUNITY BULLETIN BOARD	EACH
2990.15	WEATHERED STEEL LANDSCAPE CURB	LINEAR FOOT

PART 1 – GENERAL

1.1 SUMMARY

- A. The work covered under this Section includes the furnishing of all labor, equipment, appliances and materials, and in performing all operations in connection with installation of the following:

1. Steel Bench
2. 6' Wood Lattice Fence and Gate
3. Bike Ring (City Standard)
4. Bike Rack (Parabolic)
5. Solar Trash/Recycling Combination
6. Trash Receptacle – City Standard
7. Custom Wood Slat Bench Top; Metal Frame, Armrests, and Perforated Backs
8. Public Art Sculpture Concrete Footing
9. Public Art Sculpture Installation Assistance
10. Transport and Reset Monument of Mayor Vellucci
11. Metal Table with Perforated Chess Board Top (Moveable)
12. Metal Chair with Armrests (Moveable)
13. Metal Chair Without Armrests (Moveable)
14. Community Bulletin Board
15. Weathered Steel Landscape Curb

1.2 RELATED WORK

- A. Section 02780: Precast Concrete Pavers
- B. Section 02901: Planting Soils
- C. Section 02995: Granite Masonry for Landscape
- D. Section 03300: Concrete Footings

1.3 SUBMITTALS

- A. At least thirty (30) days prior to intended use, the Contractor shall provide the following submittals for approval.

- B. Shop Drawings, Manufacturer's Literature, and installation instructions for each item included within this specification section. Submit powdercoat finish samples for approval for each item included within this specification section.
1. Shop Drawings: submit shop drawings of the custom wood slat bench tops, metal frames, metal armrests, and perforated metal backs. Shop drawings shall indicate size, dimensions, materials, finish, connections, foundations and anchorage, and all other items required for complete installation. Note that shop drawings for granite base are per specification Section 02995: Granite Masonry for Landscape and shall be coordinated with shop drawings for custom wood seating surface and metal back.
 2. Shop Drawings: submit shop drawings of the
 3. Shop Drawings: submit shop drawings of the concrete footing for public art sculpture. Shop drawings shall indicate size, dimensions, materials, finish and connections, and anchorage and all other items required for complete installation of the sculpture footing. All measurements and location coordinates shall be field verified and approved by owner's representative.
 4. Shop Drawings: Submit shop drawing of Community Bulletin Board including size, dimensions, materials, finishes, connections and anchoring.
 5. Shop Drawings: Submit shop drawings for Weathered Steel Landscape Curb including welds, bends and lengths.
- E. Mock Ups:
1. A mock-up of the custom wood slat bench tops, metal frames, metal armrests, and perforated metal backs shall be provided showing angle of back from seating surface and all material finishes, fasteners and mounting hardware.
 2. A mock-up of the Wood Lattice Fence shall be provided showing all finishes, fasteners and all mounting hardware.
- F. Schedule for Art Installation: At least 30 days prior to intended installation day, the Contractor shall provide a written schedule and written coordination strategy including equipment, and labor related to the assisting of installation of the public art sculpture by artist Mark Reigelman.
- G. Schedule and Retrieval and Protection Plan for Monument: At least 30 days prior to intended relocation of monument, submit plans for transport, storage and attaching monument. The statue is currently being stored within Cambridge city limits (Alewife Vicinity) and contractor shall retrieve it, protect it and transport it from the storage site to the project site.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store work under this Section in a manner to prevent wracking or stress of components, and to prevent mechanical damage or damage by the elements.
- B. Handle products in accordance with manufacturer's instructions. Store products in manufacturer's original packaging until ready for installation. Protect products from impacts and abrasion during storage.
- B. Items which become chipped, rusted or damaged in any way because of non-compliance with these conditions will be rejected and shall be replaced without additional cost to the City.
- C. Deliver bolts and other small items required for erection of work under this Section bundled with their respective items.

1.5 QUALITY ASSURANCE

- A. Installation of all Site Furnishings shall be done only after excavation and construction work which might damage them has been completed.
- B. Damage caused during installation shall be repaired and /or replaced prior to acceptance and at the Contractors cost.
- C. 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.
- D. Site Furnishings shall be installed in a workmanlike manner.
- E. 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.
- F. Operator Qualifications: A forklift operator and associated team to manage the moving of the art work from the delivery flatbed truck to intended location on the site shall have a record of careful and successful movement of large irregularly shaped items and be able to accept direction and feedback from artist.
- G. Contractor shall be responsible for any damage to the public art sculpture during the off-loading from the delivery truck and moving of the sculpture to the final location. Contractor shall be responsible for costs to repair any damage to sculpture.
- H. Contractor shall be responsible for any damage to the existing sculptural bust of

Mayor Vellucci monument during loading, transport and/or handling of the monument to the final location. Contractor shall be responsible for costs to replace the monument in the event of any damage.

PART 2 - PRODUCTS

2.1 STEEL BENCH

A. Shall be 6' long Series 58-60, steel bench, as manufactured by DuMor Site Furnishings, or approved equivalent product. No center arm-rest.

1. Seating Surface: ¼"x 1-1/2" steel bar and 2-3/8" O.D. steel pipe

2. Supports: Cast iron

3. Bracing: 1-1/16" O.D. steel pipe

4. Fasteners: Stainless steel

5: Finish: Polyester powder coat "black".

B. Mounting

1. Benches are secured with four ½" dia. x 9" long stainless steel anchor bolts.

C. Finish

1. Bench finish will be a black powdercoat finish. Steel to be shot blasted, phosphatized, preheated and then coated with a TGIC exterior rated powder. All parts of bench shall be finished to an average of 8 to 10 mil thickness and fully cured to the manufacturer's specifications.

2.2 6' WOOD LATTICE FENCE AND GATE

A. Shall be as manufactured by Precision Fence of Dedham, MA, Reliable Fence of Woburn, or Walpole Outdoors or approved equivalent product. Fence shall be Northern White Cedar framed lattice fence with 6x6 square posts and pyramidal caps. 4' wide gate to abutters property shall match existing. All fasteners and hardware shall be hot dip galvanized.

2.3 BIKE RING (CITY STANDARD)

A. 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.

2.4 BIKE RACK (PARABOLIC)

- A. Shall be “Bola” model as manufactured Landscape Forms, Inc., 431 Lawndale Ave., Kalamazoo, Michigan 49048, Phone # 800-521-2546, www.landscapeforms.com or approved equal product. Rack shall be stainless steel and have capacity for two bikes and be made of 1.5” o.d x .120” wall stainless steel tubing with a #4 satin electropolish finish. Height shall be 32” and width 28.26”.

2.5 TRASH RECEPTACLES

- A. Solar trash/recycling type 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.
- B. City standard type shall be Model SD-42, “Ironsites Series Litter Receptacle”, side-door opening with lock, with removable S2 dome top, as manufactured by Victor Stanley, Dunkirk, MD or approved equivalent product. Supply complete with steel pickets, framework, hardware and fasteners. Supply receptacle with anchor supports. All steel components, including frame and slats, shall be painted with an acrylic polyurethane primer and topcoat. Color shall be black, as approved by the Engineer.

2.6 CUSTOM WOOD SLAT BENCH TOP; METAL FRAME, ARMRESTS, AND PERFORATED BACKS

- A. Custom Benches 1-10 shall be modified standard “Knight” and “Vector” benches as manufactured by Forms+Surfaces, located at 30 Pine Street, Pittsburgh, PA 15223. Contact Dan Delongchamp at dan.delongchamp@forms-surfaces.com or 617-780-4134; or approved equal.
- B. Materials:
 - 1. Seat slats shall be
 - a. FSC 100% Ipé hardwood FSC material reference: FSC-SCS-COC-001461 / FSC 100% FSC license code C004453
 - 1) Compressive hardness 3684 lbs/ft on the Janka hardness scale
 - 2. Bench frame: solid aluminum with invisible welds.

3. Slat fasteners: recessed stainless steel.
4. Armrests: solid aluminum.
5. Backs: solid aluminum plate with a perforated pattern designed by the landscape architect. Landscape architect shall provide EPS file for pattern of perforations on metal backs.

C. Finishes

1. Bench slats:
 - a. Wood: Penofin hardwood formula “Transparent Natural.”
2. Bench frame, armrests and perforated backs: graffiti resistant polyester powdercoat
 - a. Textured polyester powdercoat selected from manufacturers available colors. Final color to be selected by the landscape architect.
 - 1) All metal parts to undergo tri-chrome dipping process to provide highest achievable bond for powdercoated surfaces. Phosphate washing will not be acceptable as the cleaning procedure for metals to be powdercoated.
 - 2) Physical specifications of textured powdercoat to meet or exceed the following:

TEST	STANDARD	TEST PERIOD	RESULT	TEST
Gloss Retention	DIN EN ISO 16474-2	1000H	>90%	Gloss Retention
Condensation Test	DIN EN ISO 6270 CH	1000H	no infiltration, no bubbles	Condensation Test
Salt Spray	DIN EN ISO 9227 AASS	1000H	no infiltration, no bubbles	Salt Spray

D. Dimensions

1. Refer to detail sheets and layout plan drawings.

E. Mounting:

1. Wall-top mounting for benches 1-10: Provide 304 stainless steel surface mounting hardware with tamper resistant bits with low profile button head tops. Provide manufacturer provided epoxy for mounting stainless steel anchors.

2.7 PUBLIC ART SCULPTURE CONCRETE FOOTING

- A. Contractor shall construct concrete footing with helical piles for the sculpture as shown in the drawings by the structural engineer. Location of footing shall be field verified and coordinated with artist and engineer.

2.8 PUBLIC ART SCULPTURE INSTALLATION ASSISTANCE

- A. Contractor shall provide and submit schedule and coordinate the arrival of public art sculpture with the artist, Mark Reigelman. [Note that design and fabrication of sculpture is not included in this contract. For information purposes only: the public art sculpture will be fabricated of Cor-ten steel plate and weighs approximately 3400 lbs.] An image of the sculpture is included in Appendix H of the specification.
- B. Contractor shall coordinate and provide installation assistance to public artist, Mark Reigelman and his fabricator on-site by:
 - a. Anticipating and coordinating timing and arrival of delivery vehicle. [Sculpture will be fabricated in Colorado]
 - b. Off-loading deer sculpture from flat bed truck with fork lift;
 - c. Moving sculpture to the position approved by artist on footing previously installed by contractor;
 - d. Allowing Artist and his fabricator to make on-site measurements, for placement of threaded rods, when sculpture is in approved location;
 - e. Moving sculpture off of footing to allow fabricator to drill holes in footing and install and epoxy in place threaded rods for sculpture installation;
 - f. Allowing necessary time for curing of epoxied threaded rods installed by artist and fabricator;
 - g. Upon receiving approval from artist that curing time is complete, moving sculpture back into final position.
 - h. Note that fabricator and artist will complete fastening of deer to footing and contractor assistance shall not be needed.
- C. Forklift and operator and labor as needed to move metal sculpture off flatbed delivery truck and into position as directed by fabricator and artist. (approximate weight 3400lb) Final placement shall be approved by the artist. And as per above, contractor shall anticipate moving the sculpture three times.

2.9 TRANSPORT AND RESET MONUMENT OF MAYOR VELLUCCI

- A. Monument is existing granite bust of Mayor Vellucci and associated inscribed base. Monument and base are currently being stored by the City of Cambridge in the Alewife area of the City. The contractor shall protect, transport from storage area to the project site and re-install on a new additional granite base as described in Section 02995: Granite Masonry for Landscape. Contractor shall coordinate with the city and engineer to arrange for pick-up and location. An image of the granite bust and inscribed based is included in Appendix I.

2.10 MOVEABLE FURNITURE

- A. Metal Table with perforated chess board top shall be “Steelhead” Table Top with “Cantena” Support, as manufactured by Landscape Forms, Inc., 431 Lawndale Ave., Kalamazoo, Michigan 49048, Phone # 800-521-2546, www.landscapeforms.com or approved equal.
- a. Quantity of Metal Tables shall be 9.
 - b. Table Top: Table shall be 36” diameter with no umbrella hole.
 - c. Table top insert shall be set in a 1-1/2” outer diameter tubular frame reinforced with steel channels beneath the top.
 - d. Table top insert shall be perforated 12 gauge cold rolled steel with 1/4” square holes on 7/16” straight centers. All tables shall have perforations in checkerboard pattern to be used as game tables.
 - e. Table Support: Support shall be freestanding, formed of cast iron
 - f. Finish of Table Top and Support shall be a rust inhibitor primer. Topcoat shall be Thermosetting polyester powder coat. UV, chip, and flake resistant. Color to be selected from manufacturer’s standard color palette by landscape architect.
- B. Metal Chair with armrests shall be “Verona” as manufactured by Landscape Forms, Inc., 431 Lawndale Ave., Kalamazoo, Michigan 49048, Phone # 800-521-2546, www.landscapeforms.com or approved equal.
- a. Quantity of Metal Chairs with Armrests shall be 18.
 - b. Chair shall be 3/4” tubular steel. Seat insert shall be metal grid.
 - c. Finish of Chair shall be a rust inhibitor primer. Topcoat shall be Thermosetting polyester powder coat. UV, chip, and flake resistant. Color to be selected from manufacturer’s standard color palette by landscape architect.
- C. Metal Chair without armrests shall be “Verona” as manufactured by Landscape Forms, Inc., 431 Lawndale Ave., Kalamazoo, Michigan 49048, Phone # 800-521-2546, www.landscapeforms.com or approved equal.
- a. Quantity of Metal Chairs without Armrests shall be 18.
 - b. Chair shall be 3/4” tubular steel. Seat insert shall be metal grid.

- c. Finish of Chair shall be a rust inhibitor primer. Topcoat shall be Thermosetting polyester powder coat. UV, chip, and flake resistant. Color to be selected from manufacturer's standard color palette by landscape architect.

2.11 COMMUNITY BULLETIN BOARD

- A. Community Bulletin Board is City of Cambridge Standard 2-post ornamental steel community bulletin board as shown in the drawings.
Posts are 11 gauge 3"x3" square steel. Arch is 11 gauge 2"x2" square tube steel. Frame is 1/2"x 2" flat stock steel. Surface of bulletin board is 11 gauge steel sheet with 3/8" perforations. Plates are 1/2" x 5" x 5" plate steel and 3/4" x 8" x 8" steel plate. All hardware shall be stainless steel. Finish shall be 1 step shop applied zinc rich primer with two coats of shop applied finish paint from Tnemec or equal.

2.12 WEATHERED STEEL LANDSCAPE CURB

- A. Weathered Steel Landscape Curb shall be 1/4" A588 COR-TEN steel plate. Curb shall be bent at angles shown in the drawings. Deformed re-bar shall be welded to the steel plate in manner and frequency as shown in the drawings.
- B. Weathered Steel Landscape Curb raw material shall be pre-weathered outdoors for a minimum of 12 months prior to fabrication.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install all site furnishings plumb and vertical on concrete foundations or as recommended by the manufacturer and as shown on the drawings. Install all items according to the manufacturer's installation instructions.
- B. The use of expansion or shield anchors in place of embedded J-bolts is prohibited.

3.2 STEEL BENCHES, BIKE RACKS/RINGS AND TRASH RECEPTACLES

- A. 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.

3.3 CUSTOM WOOD SLAT BENCH TOP; METAL FRAME, ARMRESTS, AND PERFORATED BACKS

- A. Shop fabricate wood components with openings and attachments to minimize cutting, drilling and other field adjustments.
- B. 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.
- C. 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.
- D. 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.
- E. Provide concrete foundations and maintenance strips, anchorage devices and fasteners for securing site furnishings items in place.
- F. Install concealed gaskets, joint filler, insulation, and flashings as work progresses.
- G. 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.
- H. Retain protective coverings intact and remove simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.
- I. 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.

- J. 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.

3.4 PUBLIC ART INSTALLATION ASSISTANCE

- A. Contractor shall work in cooperative and collaborative manner anticipating schedule and communicating with the engineer and artist about timing of installation.
- B. Contractor shall provide all necessary effort on-site to artist to ensure a smooth installation of sculpture.
- C. Any damage to the sculpture which is the fault of the contractor shall be fixed or repaired at the expense of the contractor and at the direction of the artist.
- D. Sculpture shall be installed plumb on the footing provided by the contractor. Contractor shall assist the artist with mechanical fastening of sculpture to footings.

3.5 TRANSPORT AND RESET MONUMENT

- A. Monument is existing granite bust of Mayor Vellucci and associated inscribed base. Monument and base shall be retrieved from city's storage location near Alewife and re-install the monument on a new additional granite base as described in Section 02995: Granite Masonry for Landscape. Contractor shall coordinate pick up with engineer and provide adequate packing material to protect the monument in transit.
- B. Contractor shall install monument in orientation as directed by the engineer and shall be plumb and true.
- C. Any damage to the monument which is the fault of the contractor shall be fixed or repaired or replaced at the expense of the contractor and at the direction of the engineer.

3.6 MOVEABLE FURNITURE (TABLE WITH PEFORATED TOP, METAL CHAIR WITH ARMRESTS, METAL CHAIR WITHOUT ARMRESTS)

- A. Moveable furniture shall be unpacked from delivery truck. All packaging material shall be removed from site. Moveable furniture shall be protected from damage and/or theft until the project is officially turned over to the City. Any damaged or missing pieces of furniture shall be replaced at the contractor's expense.

3.7 WEATHERED STEEL LANDSCAPE CURB

- A. Weathered Steel Landscape Curb shall be installed plumb and true in heights as indicated in the contract drawings. Lengths shown in the drawings shall be confirmed in the field to achieve continuous length of weathered steel landscape curb between segments of stone bench bases in locations as shown on the drawings.

PART 4 - COMPENSATION

Item 2990.1 Steel Bench

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the actual number of each bench installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods required to install bench as indicated in the Contract Drawings or as required by the Engineer. The work includes, but is not limited to; furnish and install bench.

Item 2990.2 6' Wood Lattice Fence and Gate

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the linear foot installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods required to install 6' Wood Lattice Fence and Gate as indicated in the Contract Drawings or as required by the Engineer. The work includes, but is not limited to; furnish and install 6' Wood Lattice Fence and Gate.

Item 2990.3 Bike Ring (City Standard)

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the actual number of each bike ring installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish and install bike ring.

Item 2990.4 Bike Rack (Parabolic)

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the actual number of each bike rack installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish and install bike racks.

Item 2990.5 Solar Trash/Recycling Combination

Item 2990.6 Trash Receptacle – City Standard

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the actual number of each trash receptacle installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish and install trash receptacles.

Item 2990.7 Custom Wood Slat Bench Top; Metal Frame, Armrests, and Perforated Backs

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on a lump sum of custom wood slat bench tops, metal frames, metal armrests, and perforated metal backs installed as described herein and as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish and install custom wooden seating surface and backs.

Item 2990.8 Public Art Concrete Footing

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on a lump sum of installed art concrete footing as described herein and as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to coordinate and provide public art concrete footing.

Item 2990.81 Public Art Installation Assistance

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on a lump sum of executed art assistance as described herein and as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to coordinate and provide assistance for public art installation.

Item 2990.9 Transport and Reset of Monument of Mayor Vellucci

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on a lump sum to remove, store and reset monument on new base as indicated in the Contract Documents or as required by the Engineer. New granite base shall be paid for under item 2995.2 Granite Vellucci Monument Base.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to remove and reset monument on a new base. New granite base shall be paid for under item 2995.2 Granite Vellucci Monument Base.

Item 2990.11 Metal Table with Perforated Chess Board Top (Moveable)

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the actual number of each table furnished and installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full

compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish and install metal tables with perforated chess board tops.

Item 2990.12 Metal Chair with Armrests (Moveable)

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the actual number of each chair furnished as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish metal chair with armrests.

Item 2990.13 Metal Chair without Armrests (Moveable)

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the actual number of each chair furnished as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish metal chair without armrests

Item 2990.14 Community Bulletin Board

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the actual number of community bulletin boards furnished as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish and install community bulletin board.

Item 2990.15 Weathered Steel Landscape Curb

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on the linear feet of Weathered Steel Landscape Curb installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, incidental work and construction methods to furnish and install weathered steel landscape curb.

END OF SECTION 02990

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SECTION 02995

GRANITE MASONRY FOR LANDSCAPE

2995.1	GRANITE BENCH BASE	LUMP SUM
2995.2	GRANITE VELLUCCI MONUMENT BASE	LUMP SUM
2995.3	GRANITE VELLUCCI PLAZA WALL	LUMP SUM
2995.4	GRANITE LANDSCAPE CURB & PLANTER WALLS	LUMP SUM

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The work covered under this Section includes the furnishing of all labor, equipment, appliances and materials, and in performing all operations in connection with installation of the following:
1. Granite Bench Base
 2. Granite Vellucci Monument Base
 3. Granite Vellucci Plaza Wall
 4. Granite Landscape Curb and Planter Walls

1.2 RELATED WORK

- A. Section 02210: Earth Excavation, Backfill, Fill and Grading
B. Section 02990: Site Furnishings
C. Section 03300: Concrete Footings

1.3 DESIGN CRITERIA

A Installer Qualifications

1. The stone work specified herein and indicated on the Drawings shall be performed by a firm who can furnish supporting evidence of installation experience to perform this work and who has regularly been engaged in stone installation on a full time basis for a period of not less than 10 years.

B. Source Quality Control

1. The Engineer may, during the course of the work, visit the approved Contractor's places of fabrication and quarries. The Contractor shall afford these representatives free access and cooperation in the performance of their duties.
2. Design Guidelines: The Drawings and specifications are to be considered as a design

guide describing the desired profiles and the required design features. All methods proposed and detailed by the Contractor must conform to these guidelines. In the interest of economy, fabrication, erection, weatherability or the ability to satisfy the performance requirements, minor profile adjustments or internal conceptual design modifications may be made upon written acceptance from the Engineer and provided the general design and intent of the Drawings and specifications are maintained. The Contractor is required to make any and all changes that will benefit or enhance the design guidelines as described in the contract documents.

- a. Verify all dimensions at site by accurate field measurements before final fabrication of granite. Coordinate fabrication schedule with construction progress as directed by Contractor to avoid delay of work.
3. Computer Numeric Control (CNC): Stone is to be fabricated as per the contract documents using the latest version of Rhinoceros 3D computer-aided design application software. To ensure accuracy, all stone to be milled using 5-axis CNC equipment.
4. Shop Drawings: Shop drawings are to be based on surveyed site conditions after the wall footings and foundations have been poured in place.
5. Safety Factors: Design metallic components using load combinations as produced in Article 4 ANSI A58.1-1972. Basic allowable stresses shall be established in the AISC Code.

C. Tolerances for Stonework

1. Variation from true plane, or flat surfaces, determined by use of a 4 foot straightedge, applied in any direction on the surface shall not exceed 1/16 inch.
2. Joints: grouted, 1/4" minimum, 3/8" max.

D. Reference Standards

1. National Building Granite Quarries Assoc., Inc. (NBGQA).
2. American Society for Testing and Materials (ASTM). ASTM C15, "Standard Specification for Granite Building Stone".
3. American Institute of Steel Construction (AISC).
4. American National Standards Institute (ANSI).
5. Massachusetts Department of Transportation, Highway Division, Standard Specifications for Highways and Bridges, latest edition.

E. Definitions

1. The definition of trade terms shall be those published by the National Building Granite

1.4 SUBMITTALS

A. If a substitute is proposed as an “approved equivalent product” to an item named in this Section, submit sufficient evidence to prove objectively that the item conforms to this Section and is equal to the named item.

B. General: Submit the following:

1. Shop Drawings

- a. The Contractor shall prepare and submit shop and erection Drawings for Granite Bench Base, Engraved Granite Bench Base, Granite Vellucci Monument Base, Granite Vellucci Plaza Wall, Granite Landscape Curb and Planter Wall elements to the Engineer for review prior to fabrication.
- b. Shop Drawings shall be submitted for each type, finish and variation of stone element.
- c. Submit plans, sections and details noting each stone as shown on the Drawings and its dimensions, any necessary details for lifting and reception of other work, back-up, setting bed, reinforced concrete base, joint arrangement, size and treatment, finish, special cutouts to accommodate other trades and assemblies.
- d. Note that shop drawings for custom wood seating surface and metal back are per specification Section 02990: Site Furnishings and shall be coordinated with shop drawings for granite masonry for landscape.
- e. Submit supplier’s certification of specification compliance for each type of granite block and granite veneer supplied.

2. Indicate type, size and finish for each stone.

3. Dimensions must be verified in the field to coordinate with the work of other trades.

- a. Provide special details noting penetrations and holes required. Clearly indicate adjacent work, provided by other trades.

4. Backfill material submittals are in accordance with Section 02210.

5. Concrete Base Slab submittals are in accordance with MassDOT Standard Specifications Section 900.

C. Brochures

1. Submit specifications and other data for each type of stone required. Include instructions for handling, storage, installation and protection of each type. Include

recent physical property data obtained and certified by an independent testing laboratory for each type and thickness of granite.

2. Submit complete manufacturer's brochures of the following for review by the Engineer prior to delivery, installation or use. Brochures shall be marked up to indicate all products to be employed in the work including technical data, in order that a proper evaluation can be made of the materials, methods, assemblies and construction to be provided.
 - a. Grout mixes
 - b. Mortar and admixtures.
 - c. Expansion joint materials
 - d. Stone patching materials.
 - e. Acid wash cleaning material - product specifications, detailed cleaning procedures and method of protection of plant material.
3. Submit procedures for the repair and/or replacement of stones before and after installation.

D. Samples

1. Samples of the following items shall be submitted for review and approval prior to ordering any material.
 - a. Two each of 12 inch x 12 inch samples of each type of granite furnished with finishes as specified, and anchors required for Engineer approval. These samples shall indicate the general character, range of color and special characteristics of the material, together with the finishes and textures required. Due to the fact that the stone is a natural product and may have variations, it is the contractor's responsibility to assure that the samples to be submitted are true representations of such variations. Provide representative sample of finish.
 - b. Granite Engraving - Submit three (3) samples showing final finishes, line work and text for review and approval by owner's representative.
 - c. Mortar color - Submit samples of color pigmented mortar showing actual colors available for selection by the Engineer.
 - d. Stainless Steel – Provide dowel sample, material description, and shop drawing for Engineer approval.

E. Mockup

1. The Contractor shall prepare a mock-up section of the bench base wall at the project site to demonstrate assembly of granite wall system and shall exhibit proposed color

range, texture, bond, jointing, pattern, and workmanship.

- a. Mock-up is not for granite approval – granite samples and shop drawings shall be approved prior to mock-up assembly.
- b. Mock-up shall be a minimum of 10'-0" in length and shall include a terminal end of the bench base wall. Contractor shall use the methods and materials proposed for use on the final installation.
- c. Mock-up shall be inspected by Engineer for approval. If the mock-up is not acceptable, construct additional mock-ups at no cost to the Owner until an acceptable mock-up is constructed. The approved mock-up shall serve as a standard of appearance for the final work and may be incorporated into the final work.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Carefully pack and load finished stone for shipment using reasonable and customary precautions against damage in transit. No material which may cause staining or discoloration shall be used for blocking or packing.
- B. Handle stone to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges of stone with wood or other rigid materials. Lift with wide-belt type slings; do not use wire rope or ropes containing tar or other substances which might cause staining. If required, use wood rollers and provide cushion at end of wood slides.
- C. Upon receipt at the site, stack stone on timber or platforms at least 4 inches above the ground. Take care to prevent staining during storage. Place polyethylene or other suitable plastic film between any wood and finished surfaces and use also as an overall protective covering.
- D. Delivered materials shall be identical to the previously acceptable samples and mock-up. Remove materials which are damaged or otherwise not suitable for installation from the job site and replace with acceptable materials.
- E. Deliver and store manufactured materials, such as cement, sand and admixture in manufacturers' sealed containers, plainly marked for material identification, and store under cover to prevent intrusions of water or foreign materials.
- F. Deliver other manufactured items in containers and packages clearly marked and identified as to type and kind.
- G. Any piece of stone delivered to the job site which exhibits flaws, imperfections, dimensional errors, improper tolerances, or is not considered acceptable will be rejected

and such stone shall be removed from the job site and replaced so as not to delay job progress.

- H. Provide all anchors and anchoring devices necessary for the completion of this work in such a way that the work of other sections of this specification is not delayed.

1.6 SITE CONDITIONS

A. Environmental Requirements

1. The Contractor shall verify site conditions to assure that the requirements in the storage of materials and installation procedures conform to the "Recommended Practices and Guide Specifications for Cold Weather Masonry Construction," published by the International Masonry Industry All-Weather Council, latest edition.
2. Erect no stone which is covered by frost, snow, or under environmental conditions which will be detrimental to its installation. Same applies to anchoring devices.
3. All masonry materials used in freezing weather shall be at a temperature between 50 degrees and 90 degrees Fahrenheit and the mortar, when used, shall have a temperature between 60 degrees and 80 degrees Fahrenheit. Protect masonry against freezing for at least 48 hours after being laid. Anti-freeze admixtures will not be allowed in the mortar. No frozen work shall be built upon. Any completed work found to be affected by frost shall be taken down and rebuilt.

B. Project Coordination

1. The work shall be coordinated with the work supplied and installed by others.

1.7 REPAIR AND REPLACEMENT

- A. The intent of this Section is to provide for the repair of defects in granite in such a way as to produce a structurally sound and aesthetically pleasing stone regardless of whether the defects naturally exist in the stone or were produced or exacerbated during quarrying, fabrication, handling, or erection.
- B. Repair and replacement procedures must be approved in writing by the Engineer before being used.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Obtain accepted stone and setting materials from one source or quarry having sufficient quantity to meet the requirements of this project.
 - B. The stone material specified herein: the best quality of its respective kind, of sound stock, uniform in texture, color and markings, and free from stains, cracks, seams, discolorations or defects which may impair its strength, durability or appearance. Granite shall comply with the requirements of ASTM C615 and National Building Quarries Association, Inc. Specifications.
 - C. Source limitations for stone:
 - 1. Provide matched blocks of stone, regardless of finish, from the same location in a single quarry located 500 miles radius or less from project site and with resources to provide materials of consistent quality in appearance and physical properties, including the capacity to cut and finish material without delaying the progress of the Work.
 - 2. Extract blocks from a single bed of quarry stratum, especially reserved for Project. Provide matched blocks from a single quarry for each type, variety, color and quality of stone required. Randomly selected blocks of similar color/character are not permitted without written approval of the Landscape Architect.
 - D. Granite Engraving:
 - 3. Granite lettering shall be engraved and textured by a qualified granite engraver with the capability of precisely translating vector file line work directly on to granite without having to re-draw map. Owner's representative will provide .eps linework drawing.
 - 4. Contractor shall provide up to three (3) samples showing final finishes, line work and text for review and approval by owner's representative.
 - E. Mortar and setting materials: Non-staining and completely compatible with the type of stone specified.
 - F. Backfill materials are in accordance with Section 02210.
 - G. Concrete Base Slabs are in accordance with Section 900 of the MassDOT Standard Specifications.
- 2.2 GRANITE BENCH BASE, GRANITE VELLUCCI MONUMENT BASE, GRANITE VELLUCCI PLAZA WALL, GRANITE LANDSCAPE CURB AND PLANTER WALLS
- A. Stone for use in Granite Bench Base, Granite Vellucci Monument Base, Granite Vellucci Plaza Wall, Granite Landscape Curb and Planter Walls shall be either:

1. “Jet Mist,” from Rapidan, Virginia, USA; or
2. “Chelmsford,” from Chelmsford, Massachusetts, USA; or
3. “Freshwater Pearl,” from Frankfort, Maine, USA

B. Stone shall be supplied and manufactured by either:

1. Structural Stone, LLC., located at 285 Smith Street, North Kingstown, RI 02852; Contact Angela Conte at (401) 667-4969; or
2. Coldspring, located at 17482 Granite West Road, Cold Spring, MN 56320; Contact Michael Butler at (339) 832-1656; or
3. Freshwater Stone, located at 4 Upper Falls Road, Orland, ME 04472; Contact Bill Zildjian at (207) 469-6331

B. Finishes shall be:

1. Exposed faces, unless noted otherwise and shown on the drawings: “Thermal”
2. Exposed faces, as noted and shown on drawings: “Honed”
3. Bottom and all hidden faces: “Sawn”

C. Standard stone lengths for use at Granite Landscape Curb shall not be less than 6’ unless they are end pieces or smaller lengths required as per the drawings.

2.3 SETTING BED MORTAR

A. Setting bed mortar shall conform to ASTM C 270, Type S, except that latex polymer additive shall be mixed with the cementitious materials and aggregate in lieu of water.

1. Cement shall conform to ASTM C 150, Type II, complying with the staining requirements of ASTM C 91 for not more than 0.03 percent water soluble alkali. Fifteen percent additional cement may be used for setting granite in cold weather, (when the mean daily temperature is below 40° Fahrenheit., or is expected to fall to below 40° Fahrenheit., within 72 hours).
2. Sand shall conform to ASTM C 144, non-staining.
3. Hydrated lime shall conform to ASTM C 207.

4. Latex polymer additive shall be equal to "Laticrete 3701" setting liquid, manufactured by Laticrete International, Inc., Woodbridge, CT 06525, or equivalent products manufactured by Hydroment, Middleton, MA 01949, Mapei, South River, NJ 08882, or Jamo, Miami, FL 33166 or approved equivalent product. Mix according to manufacturer's instructions.

2.4 BOND COAT

- A. High strength bond coat between concrete base and setting bed mortar, and between setting bed mortar and granite shall be equal to "Laticrete 4237" mortar additive bond coat manufactured by Laticrete International, Inc., Woodbridge, CT 06525, or equivalent products manufactured by Hydroment, Middleton, MA 01949, Mapei, South River, NJ 08882, or Jamo, Miami, FL 33166 or approved equivalent product. Mix according to manufacturer's instructions.

2.5 MORTAR FOR JOINTS

- A. Mortar grout for joints shall consist of one part white Portland cement, two parts sand, mortar coloring additive, gauged with latex polymer additive.
 1. Except as otherwise indicated below, all mortar grout materials shall be as specified in Article 2.09 above.
 2. Cement shall be White Portland cement; ASTM C 150.
- B. Mortar grout shall contain a coloring additive. Color shall be reviewed by the Engineer.
 1. Coloring additive shall be equal to SGS Colors, manufactured by Solomon Grind Chem Service, Springfield, IL 62705, or equivalent products manufactured by Davis Colors, Beltsville, MD 20705, or New Riverside Ochre Co., Inc., Cartersville, GA 30120 or approved equal.
 2. Mortar coloring additive shall have mineral oxide pigment and shall be certified by the supplier to be resistant to alkali, light, and weather, and shall be of a chemical composition unaffected by cement and free of water and soluble salts.
 3. Color pigment in grout mixture shall not exceed 10 percent of the Portland cement content.
 4. Color shall match color of granite.

2.6 EXPANSION JOINT FILLER

1. Preformed three-eighths (3/8) inch expansion joint filler shall conform to the requirements of AASHO Designation M-33.
2. Filler and backer rod for joints abutting dissimilar materials and for smaller radius and other non-regular alignments shall consist of isomeric polymer foam meeting the physical requirements of AASHTO M153. Provide closed cell polyethylene backer rod of circular rod stock.
3. Backer rod shall be sized 33 percent larger than joint width.

2.7 SEALANT

1. Sealant shall be a self-leveling, pour grade, polyurethane-based, one component, elastomeric sealant, light gray in color, complying with Fed. Spec. TT-S-00230C, Class A, Type 1. Application of sealant shall be in accordance with the requirements of the manufacturer. Expansion joint sealant shall match color of granite.
2. Compatibility: Provide only materials that are known to be fully compatible with the actual installation condition, as shown by the manufacturer's published data or certification.
3. Joint Primer: Use sealant manufacturer's recommended primer.

2.8 MISCELLANEOUS ITEMS

- A. Cushions to maintain joints: Lead or plastic buttons, 1-1/2 inch diameter. x 1/2 inch thick or 1 inch x 1 inch x 1/2 inch thick.
- B. Stainless Steel. Stainless steel shall be grade 304 or 316. Dimensions shall be as indicated on the drawings and exposed sides shall have no sharp corners or edges.
- C. Stainless Steel Skateboard Deterrent Fins. Skate deterrent fins shall be 1/4" stainless steel plate. Dimensions and profiles of fins shall be as indicated on the drawings. Fins shall be anchored with 1/2" x 6" stainless steel threaded rod through holes in the plate and set with epoxy.

2.9 FABRICATION OF CUT STONE

- A. Fabricate as shown and as detailed on final shop Drawings and in compliance with recommendations of applicable stone association. Provide holes and sinkages cut or drilled for supports and lifting devices, as shown and as necessary to secure stonework in place. Cut and back-check as required for proper fit and clearance.

- B. Cut holes and other cutouts to accommodate items within section 2990 Site Furnishings, including Vellucci monument and custom wood seating surface, and other site elements which will not impair the strength or the appearance of the stone. Execute cutting of holes through the stone work using proper templates, verified field dimensions and the reviewed shop Drawings to coordinate with the Drawings. Granite shall be shop cut unless approved otherwise by the Engineer.
- C. Coordinate with site elements which penetrate stone pavements and other stone elements.
- D. Cut accurately to shape and dimensions shown on final shop Drawings, maintaining fabrication tolerances or applicable stone associations. Accurately form radii and slopes.
 - 1. Fabricate special members for the corners, junction with walls and copings and other elements as noted.
 - a. Granite veneer and caps at existing utilities including site lighting shall be cut to form true radii, joints between stones shall be cut at the angle required to maintain the smooth curve and even joints from edge to edge of stone.
- E. Provide stone of thickness indicated and specified.
- F. Provide lifting devices for large members with holes to accommodate approved industry standard lifting devices. Holes shall not come closer than 2 inches from the finished face of the stone. Provide holes and cut-outs for other metal items required for handling and setting of the stones. Holes and cut-outs, required for handling, will not be permitted on exposed faces on the work.

PART 3 – EXECUTION

3.1 GENERAL

- A. The work of this Section shall be coordinated with that of associated trades.
- B. The Contractor shall be fully responsible for the proper execution and performance of the work described herein.

3.2 INSPECTION

- A. The Contractor shall inspect all surfaces, areas and other contingent construction in or to which his work is to be installed and insure himself that they are in proper condition to receive the work to be performed under this Section. Contractor shall notify the Engineer in writing, before any work is installed, of any conditions requiring correction. Failure to make such a report shall be construed as acceptance of the existing conditions and it shall be the responsibility of the Contractor to provide an acceptable installation.

- B. Verify dimensions taken at the job site affecting the work. Bring field dimensions which are at variance to the attention of the Engineer. Obtain decision regarding corrective measures before the start of fabrication and/or installation of items affected.

3.3 EXCAVATION AND BACKFILL, GRAVEL SUB BASE

- A. Excavation, filling, grading, sub base preparation and backfill are in accordance with Section 02210.

3.4 REINFORCED CONCRETE BASE

- A. Reinforced concrete base is in accordance with Section 900 of the MassDOT Standard Specifications.

3.5 PREPARATION

- A. Field Measurements: Verify and coordinate the locations of the following:
 - 1. Openings for site furnishings.
 - 2. Existing and proposed utility structures.
 - 3. All other items affecting the completion of the work.
- B. Advise installers of other work about specific requirements relating to placement of inserts which are to be used for anchoring site elements. Furnish installers of other work with Drawings or templates showing location of inserts.
- C. Concrete surfaces which are to receive the mortar setting bed shall be cleaned of debris and broomed down to produce a clean acceptable surface free from grease, oil or other surface materials which might retard or prevent the bonding and/or set of the mortar.
- D. Clean the surfaces of each stone before setting, removing foreign matter that might impair the bedding, bonding or appearance of the work. During setting operations dirt or setting materials in contact with exposed surfaces of the stone work shall be immediately removed.
- E. Do not set patched, chipped, cracked, broken or other defective pieces of stone work. Stains which cannot be removed with clean water and fiber brushes shall be considered a defect, and such pieces shall not be used.
- F. Surfaces to which this work is to be secured and the stone surfaces themselves, shall be free from frost, wetness, dirt, grease, visible rust and foreign materials which will be detrimental to the proper execution of the work.

3.6 INSTALLATION OF STONE

A. General Requirements

1. Install stonework using skilled workmen under adequate supervision in accordance with the recommendations of the stone supplier, the details and the approved shop and setting Drawings. Stone work shall be installed by a single contractor or sub contractor.
2. Before being set, clean stone so it is free of ice and frost. Remove dirt and other foreign materials which will cause hindrance during the erection and installation operations.
3. See details and layout, drainage and electrical plans for location of utilities and irrigation plans for lines and components that penetrate or pass under the stone; all cuts in granite shall be saw cut. If openings are round, then circular openings will be made by core drilling with a diamond tip drill and flamed if required. Round openings will be symmetrical circles.
4. Exercise care to protect work already in place. Repair work damaged as a result of these stone operations at no additional cost and to the satisfaction of the Engineer.
5. Set stone to the lines and grades shown.
6. Unless otherwise noted, joints between stones, and joints between stones and other materials shall be ¼” to 3/8 inch wide. Tool exposed joints when thumbprint hard with a sled-type concave stainless steel jointer at least 16 inches long. At completion of work, cut out and repoint all holes and defective joints.
7. Cover and protect all unfinished work when not being worked on, by means of waterproof paper, tarps, or other means.
8. As the work progresses, set all anchors, bolts, and all other items furnished by other trades for installation in masonry work. No cutting and patching of completed masonry work will be permitted except as approved by the Engineer.
9. Install sealant for stone to stone joints where detailed as part of the work of this Section.
10. Keep face of stone work free of mortar and protected against damage at all times. Remove excess mortar promptly.
11. Provide transition pieces as required and where noted on Drawings.

B. Horizontal Bedding

1. Place the properly prepared relatively dry mix mortar bed over the concrete slab to the

approved thickness. Lay the stone on the dry mix, mallet the top and lift the stone. Fill voids and other irregular surfaces and screen the surface to the proper elevation.

2. Just prior to the final setting, cover the mortar bed with a thin uniform layer of the slurry bond coat.
3. Each stone shall then be lowered on to the bed in such a manner so as to eliminate entrapped air. After seating, tap the stone with the rubber mallet to its final location and elevation. Remove mortar dropping on the stone as it occurs with a clean sponge and water. Allow a 3/8" caulking space between stones and adjacent butting materials or surfaces.
4. Anchor granite units to concrete as detailed. Install granite units in sequence fashion as detailed. Maintain joint widths. Set buttons under and between stones to maintain joint widths.
5. Protect openings which are to receive railing posts from accumulation of foreign matter. Remove mortar and foreign matter as the work proceeds.

3.7 ADJUSTMENTS AND CLEANING

- A. Repair or replace broken or defective stone work as directed by the Engineer at no additional cost or time.
- B. Protect installed stone work from damage by proper and adequate means. Wood which may stain or deface the stone shall not be used.
- C. After completion of other work, and after removal of protective materials, clean the stonework of foreign matter and carefully wash and scrub down using approved and recommended means and methods. This Contractor shall provide to the Engineer a detailed written procedure for the cleaning of the stone work and the protection of all plant material. The Contractor shall be responsible for the replacement of any plant material damaged or killed as a result of this cleaning process. Exercise care during these cleaning methods to protect work already in place. Final cleaning shall start at the top of the work and work down.
- D. Examine stone surfaces after cleaning. Rake out loose or open joints and reseal and/or point as required.
- E. Remove and replace surfaces which have become damaged, or stained, during or after installation with acceptable material at no additional cost and as directed by the Engineer.
- F. Provide final protection and maintain conditions which ensures stonework being without damage, discolorations or deterioration during subsequent construction and until time of

substantial completion.

3.8 PATCHING

- A. Patching of stone will be allowed only at the discretion of the Engineer. Patching shall be executed by skilled masons. Materials used for patching shall be only those having been successfully used for at least ten years in comparable environmental conditions and in conjunction with comparable rock materials. Resulting patches shall match color and texture of adjacent (unblemished) surfaces to the satisfaction of the Engineer.

PART 4 - COMPENSATION

Item 2995.1 Granite Bench Base

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on a lump sum of granite bench and ottoman base installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, subbases, reinforcement, mortar, dowels and other incidental work and construction methods to furnish and install granite bench base.

Item 2995.2 Granite Vellucci Monument Base

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on a lump sum of granite Vellucci monument base installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, subbases, reinforcement, mortar, dowels and other incidental work and construction methods to furnish and install granite Vellucci monument base.

Item 2995.3 Granite Vellucci Plaza Wall

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on a lump sum of granite Vellucci Plaza Wall installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, subbases, reinforcement, mortar, dowels and other incidental work and construction methods to furnish and install granite Vellucci Plaza Wall.

Item 2995.4 Granite Landscape Curb and Planter Walls

METHOD OF MEASUREMENT:

Measurement for Payment shall be based on a lump sum of landscape curb and planter walls installed as indicated in the Contract Documents or as required by the Engineer.

BASIS OF PAYMENT:

Payment shall be based on the unit price bid for each item. The unit price shall constitute full compensation for complete compliance with requirements of this item, including all labor, equipment, materials, tools, subbases, reinforcement, mortar, dowels and other incidental work and construction methods to furnish and install granite landscape curb and planter walls.

END OF SECTION 02995

SECTION 03300

CONCRETE

**3300.1 CIP CONCRETE PIPES CONNECTION 15-INCH THROUGH EACH
48-INCH DIAMETER (CIP FIELD CLOSURES)**

3300.2 SPRINGFIELD STREET PARKING LOT RAMP LUMP SUM

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Furnishing, installing, and testing of cast-in-place concrete including formwork, reinforcement concrete, materials, mix design, placement procedures, and finishes.
2. Class A concrete is for reinforced concrete structures, including manhole bases, special structures, reinforced concrete fills, and similar items as applicable.
3. Class B concrete is for non-reinforced concrete including cradles, encasements, thrust blocks, plugs, and base for pavements and similar concrete whether reinforced or not.

B. Concrete for sidewalks is described in Section 02524 – CURBS, WALKS AND DRIVEWAYS.

1.2 RELATED TECHNICAL SECTIONS

A. Section 03315 – GROUT

B. Section 07160 – BITUMINOUS DAMPPROOFING

C. Section 05500 – MISCELLANEOUS METALS

1.3 SUBMITTALS

A. 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.
 - a. Indicate amounts of mix water to be withheld at plant for later addition at Project site. However, addition of water at project site shall be limited to maximum amount printed on the concrete delivery ticket. Absent this information, no water shall be permitted to be added at project site.
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. 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,
5. Detailed cold-weather protection methods.
6. Qualifications of concrete installer, manufacturer, and testing agency as specified in this Section.

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."

1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS, AND EQUIPMENT.

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, $\frac{3}{4}$ inch by $\frac{3}{4}$ 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 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, deformed.
 - 3. Plain-Steel Wire: ASTM A 1064, as drawn.
 - 4. Plain-Steel Welded Wire Reinforcing: ASTM A 1064, 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, 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: 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 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.
- F. High Range Water Reducing Admixture: ASTM C494, Type F.

2.6 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.
- 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, 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. Earth Shield Type 23; J.P. Specialties, Inc..
 - b. Hydrotite; Greenstreak.

c. Ultra Seal; Adeka Corporation

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. This product shall not be used as a substitution for curing compounds.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Volatile Organic Compounds (VOC) shall meet maximum emission limits of authorities having jurisdiction at project site.
- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 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. Evaporation Retarder:
 - i. Euco-bar; Euclid Chemical Co.
 - ii. E-Con; L&M Construction Chemicals, Inc.
 - iii. Confilm; BASF Construction Chemicals, LLC.

2.8 SEALING MATERIALS

- A. Penetrating Liquid Concrete Sealer: Clear, penetrating, and anti-spalling compound.
 - 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. Pentra-Hard EDH; Dayton Superior
 - b. Lin-Seal Clear; W.R. Meadows, Inc.

c. Baracade WB 244; Euclid Chemical Co.

2.9 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.

2.10 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. Fly ash and blast furnace slag 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	4,500	565	0.42	5+/-1	N/A	N/A	N/A	NW-3/4"
B	4,000	565	0.44	5+/-1	N/A	N/A	N/A	NW-3/4"

* Total water in mix at time of mixing, including free water in aggregates.

1. Mix Classifications: The design mix classes indicated above shall be used as indicated on the Drawings and as follows:
 - Class A: Class A shall be used on all areas indicated on the drawings as follows: Roadway (R Series). Concrete shall be integral with high-range water reducer.
 - Class B: Class B shall be used where ever low strength concrete fill is indicated.
2. Slump at point of placement shall be limited to 4"+/- 1". With addition of high-range water reducer, slump at point of placement shall be limited to 7"+/- 2".
3. 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 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. 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.

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
 - 1. When air temperature is between 85°F and 90°F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90°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 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch, for concrete surfaces exposed to view.
 - 2. Class B, 1/4 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. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
 - J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
 - K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
 - L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 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 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°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 70% 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.

3.4 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.

3.5 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 directed 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.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
 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.

3.7 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.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved in writing by 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.
 - 4. Concrete shall be carefully consolidated on each side of waterstop.
- 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°F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F and not more than 80°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°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.

3.9 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 Finishes (Formed Surfaces) Location	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.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

3.11 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. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
- D. 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. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.12 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, pop-outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. 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.

3.13 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 Section.
- 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°F and below and when 80°F and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C 31/C31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.

6. 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 that night. Also provide field cured cylinders to determine strength for form removal.
 7. 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 directed by 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 directed 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 directed by the Engineer when test results indicate requirements have not been met.

PART 4 – COMPENSATION

Item 3300.1 --- CIP Concrete Pipes Connection 15-inch through 48-inch Diameter (CIP Field Closures)

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, and leakage testing/inspection of CIP Field Closures, complete as indicated on the Drawings and Specifications, or as directed by the Owner or Engineer. This work shall include furnishing, installing, and/or performing the following: exposure and protection of existing underground infrastructure; waterseal/waterstop; reinforcement and doweling; formwork (with removal);

Class A and B concrete, and admixtures; brick masonry; dampproofing; concrete testing; and all appurtenances and incidental work.

METHOD OF MEASUREMENT:

Payment for Cast-In-Place Concrete Pipe Collar shall be based on the Unit Price bid in the proposal. Measurement for payment shall be based on the actual numbers of pipe collars installed complete and functional as shown on the Contract Drawings or as directed by the Owner or Engineer.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: trenching (paid under installed pipe item); proposed pipe to be connected; disposal of material.

Item 3300.2 --- Springfield Street Parking Lot Ramp

BASIS OF PAYMENT/INCLUSIONS:

Under the Lump Sum bid for Springfield Street Parking Lot Ramp, the Contractor shall furnish all labor, materials, tools, equipment, and incidentals required for the complete procurement, and installation complete as indicated on the Drawings and Specifications, or as directed by the Owner or Engineer. This work shall include furnishing, installing, and/or performing the following: installation of temporary ADA accessible entrance ramp; demolition and removal and disposal of the existing concrete ramp; protection of the existing building and its foundation; reinforcement and doweling; formwork (with removal); Class A and B reinforced concrete, and admixtures; dampproofing; sealant; compacted crushed stone layer under concrete ramp and stairs; concrete testing; installation of reinforced concrete stairs; installation of metal handrail; submittals of shop drawings approved by a professional engineer in the Commonwealth of Massachusetts, and all appurtenances and incidental work.

METHOD OF MEASUREMENT:

Payment for the Springfield Street Parking Lot Ramp shall be based on the Lump Sum bid in the proposal.

SPECIAL NOTES ON EXCLUSIONS:

The following item(s) are not included for payment under this item and are included for payment elsewhere: 4" concrete sidewalk; and interior and exterior building inspection.

END OF SECTION 03300

SECTION 03315

GROUT

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This Section includes the following:
1. Furnishing, installing, and testing all materials for grout including formwork, materials, mix design, placement procedures, and finishes
 2. The following types of grout shall be covered in this Section:
 - a. Cement Grout
 - b. 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.
 - c. Epoxy Grout
 - d. Topping Grout

1.2 RELATED TECHNICAL SECTIONS

- A. Section 03300 – CONCRETE

1.3 SUBMITTALS

- A. 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.
 2. Certified testing lab reports for tests indicated herein.
 3. Test results and service report from the field tests and the demonstration and training session verifying the requirements indicated herein.

4. Certifications that grouts used on the project contain no chlorides or other chemicals that cause corrosion.
5. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, curing, and appropriate uses for each type of grout used in the WORK, and location of use. The current ICC-ES or IAPMO-UES report shall be submitted for all epoxy anchor grouts for adhesive anchors.
6. Manufacturer's certification that its non-shrink grout does not contain aluminum, zinc, or magnesium powders as a method of expansion.
7. Submit manufacturer's written warranty as indicated herein.
8. Name and telephone number of grout manufacturer's representative who will give on-Site service. The representative shall have at least one year of experience with the indicated grouts.

1.4 QUALITY CONTROL

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified
- B. 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 1107. 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 no cost to the Owner.
 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.
- C. 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 4500 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%) and a maximum 4.0% expansion in the plastic state when tested in accordance with ASTM C-827; and shall have no shrinkage (0.0%) and a maximum of 0.2% expansion in the hardened state when tested in accordance with ASTM C 1090.

3. Class B non-shrink grouts shall have a minimum 28 day compressive strength of 5000 psi and shall meet the requirements of ASTM C 1090.
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% 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.
2. Available Products: Subject to compliance with regulations, products that maybe incorporated into the work include, but not limited to, the following:
 - a. Five Star DP Epoxy Grout; Five Star Products,
 - b. Sikadur 42 Grout-Pak; Sika Corporation
 - c. Materflow 648 CP Plus; BASF
 - d. or equal.
3. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.

4. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75° F.
5. 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%) and a maximum 4.0% expansion when tested in accordance with ASTM C 827.
6. The epoxy grout shall exhibit a minimum effective bearing area of 95%. 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.
7. The peak exotherm of a 2-inch diameter by 4-inch high cylinder shall not exceed 95°F when tested with 75°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.
8. Application: Epoxy grout shall be used for all other applications required in the Contract Documents, unless specified in drawings.

C. Epoxy Anchor Grout:

1. Epoxy anchor grout for use in concrete shall be certified for use in accordance with ICC-ES AC 308.
2. Epoxy anchor grout shall conform to ASTM C 881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete, Type IV, Class B & C, Grade 3 with the exception of gel time.
3. Heat deflection temperature per ASTM D 648 – Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position shall be a minimum 120 degrees F.
4. Manufacturer shall certify that the epoxy anchor grout will maintain 100 percent of its capacity up to a short term temperature of 110 degrees F and 50 percent of its capacity up to a short term temperature of 150 degrees F.
5. Grout shall come in a 2 chambered cartridge with a metering system that provides the proper ratio of hardener and resin. The grout shall

also come with a static mixer nozzle to thoroughly mix the hardener and resin together.

6. Epoxy anchor grout shall be capable of being used in submerged applications once cured.
7. Compressive strength per ASTM D 695 – Standard Test Method for Compressive Properties of Rigid Plastics shall be 10,000 psi minimum.
8. Whenever possible, overhead anchors subject to vibration, anchors in fire-resistive construction or high fire risk areas, and anchors subject to working or operating temperatures above 100 degrees F shall be cast-in-place anchors. Whenever cast-in-place anchors cannot be used in these applications, use cement based non-shrink grout and oversized holes.
9. Embedment of adhesive anchors/rebar shall be deep enough to develop the anchor/rebar unless otherwise noted on the Contract Documents. Embedment shall not exceed 67 percent of the member depth.
10. Epoxy anchor grout shall be **PE1000+ by Powers Fasteners; HIT-RE 500-SD by Hilti, SET-XP by Simpson Strong-Tie**, or equal.

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 – CONCRETE 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 4000 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 non-shrink grout and epoxy grout shall provide on-site technical assistance.
- C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the Engineer.

0.1 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 1-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° 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 ½ inches wide by 1 ½ 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

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SECTION 03410

PLANT-PRECAST STRUCTURAL CONCRETE

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Furnishing, installing, and testing of underground precast concrete structures, complete and in place, within the limits and to the lines and grades indicated.
- B. Refer to Section 02252 – MANHOLES for requirements relating to the following:
 - 1. Jointing and gaskets,
 - 2. Coatings,
 - 3. Castings,
 - 4. Masonry and building inverts,
 - 5. Flexible manhole seals,
 - 6. Installation regarding placing structure in trench, connecting pipes, building inverts, and backfilling,
 - 7. Inspection and testing of completed structures.

1.2 RELATED TECHNICAL SECTION

- A. Section 02140 – DEWATERING
- B. Section 02160 – TEMPORARY EXCAVATION SUPPORT SYSTEMS
- C. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- D. Section 02252 – MANHOLES
- E. Section 02590 – BRICK MASONRY
- F. Section 03300 – CONCRETE
- G. Section 03315 – GROUT

H. Section 07160 – BITUMINOUS DAMPPROOFING

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01300 – SUBMITTALS:

1. Complete shop drawings which show details in accordance with ACI 315 and ACI 318 for all precast structural concrete units, cast iron frames and covers and appurtenances including:
 - a. Details of structures, joints and gaskets, construction details, tolerances, and other information as required by the Owner. Indicate member locations, plans, elevation, dimensions, shapes, cross sections, openings, and types of reinforcement, including special reinforcement.
 - b. Product Data: For each type of product indicated.
 - c. Design Mixes: For each concrete mix. Prior to commencing operations, including fabrications of the precast for any mock-up, a statement shall be submitted giving the nominal maximum aggregate size and proportions of all ingredients that will be used in the manufacture of concrete. The statement shall include test results from an approved testing laboratory, certifying that the proportions selected will produce concrete of the properties required. No substitutions shall be made in materials used in the concrete mix without approval and additional tests to verify that the concrete properties are satisfactory. A copy shall be submitted of concrete mix with each set of samples.
 - d. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories.
 - e. Indicate locations and details of anchorage devices to be embedded in other construction.
2. Design drawings and calculations signed and sealed by a Professional Structural Engineer registered in the Commonwealth of Massachusetts to the Engineer.
3. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - a. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

- i. Concrete materials.
 - ii. Reinforcing materials.
 - iii. Admixtures.
4. Certificates of Compliance: Certificates of compliance shall be submitted attesting that materials and products meet or exceed specified requirements.
5. Qualification Data: List of projects/orders completed in the last 5 years demonstrating capabilities and experience as specified in the Quality Control paragraph of this Section. Include project name and addresses, and other information specified.
6. Submit manufacturer's recommended installation procedures for informational purposes.

1.4 QUALITY CONTROL

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
 1. Installer Qualifications: An experienced installer who has completed 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.
 2. 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.
 - a. 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.
 - b. 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.
 - c. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group C, Category C1.

- d. Has sufficient production capacity to produce required units without delaying the Work.
 - 3. Testing Agency Qualifications: An independent testing agency, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
 - 4. Design Standards: Comply with ACI 318 and the design recommendations of PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."
 - 5. 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."
 - 6. 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.
 - 7. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel"; and AWS D1.4, "Structural Welding Code - Reinforcing Steel."
- B. Owner reserves right to inspect and test by independent services 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.

1.6 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide precast structural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Dead Loads: 130 pcf soil load on roof.
 - 2. Live Loads: AASHTO HS-20.
 - 3. Lateral Earth Pressure; 90 psf/ft below ground level.
 - 4. Internal Fluid Pressure: Based on unit weight of 63 pcf filled from invert to finished grade with no external soil pressure.

5. Traffic Surcharge:
 - a. Vertical Load: 240 psf at the ground surface level.
 - b. Lateral Load: 120 psf at the side of the wall applied over the full height of the wall.
6. Seismically induced earth pressure is not required by Geotechnical Design recommendations from Brierley Associates, LLC.
7. Maximum allowable bearing pressure at the bottom of foundation support shall be 2000 psf. Provide 12 inches of compacted crushed stone over the compacted bearing surface.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Each structure section shall be constructed with a bell-and-spigot or tongue-in-groove joint.
- B. Structure flat tops shall be reinforced and not less than 8 inches thick. Manhole openings shall have a minimum inside diameter of 24 inches.
- C. All exterior concrete surfaces shall be coated with bituminous dampproofing as per Section 07160 – BITUMINOUS DAMPPROOFING.
- D. Jointing shall be O-ring gaskets or butyl rubber molding sealants. All joints shall be provided so as to be watertight under all conditions of service. The ends of base, riser, and top 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. Mortar for Brickwork shall be provided per Section 02590 – BRICK MASONRY.
- F. Bricks shall be provided per Section 02560 – BRICK MASONRY.
- G. Structure castings shall be provided per Section 02252 – MANHOLES.

2.2 MOLD MATERIALS

- A. Molds: Provide molds and, where required, form-facing materials of metal, plastic, wood, or another material that is nonreactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes.

2.3 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.
- C. Steel Bar Mats: ASTM A 184, assembled with clips, as follows:
 - 1. Steel Reinforcement: ASTM A 615, Grade 60, deformed bars.
- D. Plain-Steel Wire: ASTM A 82, as drawn.
- E. Plain-Steel Welded Wire Fabric: ASTM A 85, fabricated from as-drawn steel wire into flat sheets.
- F. Supports: Manufacturer's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to CRSI's "PCI MNL 116, and as follows:
 - 1. For uncoated reinforcement, use all-plastic CRSI Class 1 plastic-protected bar supports.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III, of same type, brand, and source.
- B. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse aggregates complying with Class 4S.
- C. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.
- D. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- E. Water-Reducing Admixture: ASTM C 494, Type A.
- F. Retarding Admixture: ASTM C 494, Type B.
- G. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
- H. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or better.

2.5 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36.

- B. Carbon-Steel Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished; AWS D1.1, Type A or B, with arc shields.
- C. Malleable Steel Castings: ASTM A 47.
- D. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706.
- E. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washers.
- F. High-Strength Bolts and Nuts: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
- G. Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123, after fabrication.
 - 1. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94% zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.
- H. Welding Electrodes: Comply with AWS standards.
- I. Accessories: Provide clips, hangers, plastic shims, and other accessories required to install precast structural concrete units.

2.6 STAINLESS-STEEL CONNECTION MATERIALS

- A. Stainless-Steel Plate: ASTM A 666, Type 316L, of grade suitable for application.
- B. Stainless-Steel Bolts and Studs: ASTM F 593, alloy 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.
- C. Stainless-Steel Headed Studs: ASTM A 276.

2.7 CONCRETE MIXES

- A. Prepare design mixes for each type of concrete required.
- B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318.

- D. Normal-Weight Concrete: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
1. Specified Compressive Strength (28 Days): f'_c 5,000 psi.
 2. Maximum Water-Cementitious Materials Ratio: 0.440.
 3. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows, with a tolerance of plus or minus 1-1/2 percent:
 - a. Air Content: 6% for 1-inch nominal maximum aggregate size.
 - b. Air Content: 6% for 3/4-inch nominal maximum aggregate size.
 - c. Air Content: 7% for 1/2-inch nominal maximum aggregate size.
- E. Other Admixtures: Use water-reducing, high-range water-reducing, water-reducing and accelerating, or water-reducing and retarding admixtures according to manufacturer's written instructions.
- F. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.8 FABRICATION

- A. Formwork: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances.
1. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial-formula, form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's written instructions.
- B. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or concrete placement. Do not relocate bearing plates in units unless approved by Engineer.
- C. Cast-in openings larger than 10 inches in diameter or 10 inches square according to Shop Drawings. Smaller holes may be field cut by trades requiring them, as approved by Engineer.

- D. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
 2. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete-placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.
 3. Place reinforcement to obtain at least the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
 4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Mix concrete according to PCI MNL 116 and requirements in this Section. After concrete batching, no additional water may be added.
- F. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 116 for measuring, mixing, transporting, and placing concrete.
- G. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 116.
- H. Comply with ACI 306.1 procedures for cold-weather concrete placement.
- I. Comply with ACI 305R recommendations for hot-weather concrete placement.
- J. Identify pickup points of precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint casting date on each precast concrete unit on a surface that will not show in finished structure.
- K. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.

- L. Product Tolerances: Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product tolerances.
- M. Finish formed surfaces of precast structural concrete as indicated for each type of unit, and as follows:
 - 1. Standard Finish: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.
- N. Screed finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections.
 - 1. Apply scratch finish to precast concrete units that will receive concrete fill after installation. After initial strikeoff, transversely scarify surface to provide ridges approximately 1/4 inch deep.
- O. Repair of damaged epoxy coating, when required, shall be made with patching material conforming to ASTM A 775. Repair shall be in accordance with the material Manufacturer's recommendations.

2.9 GASKETS

- A. 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.
- B. 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.
- C. 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:

<u>DESCRIPTION</u>	<u>SEALANT PROPERTY</u>
Base	Vulcanized Butyl Rubber
Percent of Solids	100%
Shore "A" Durameter:	
- Initial	10
- Aged	20
Adhesion to Clean Surfaces	Excellent
Temperature Range:	
- Application	-20° F to 120° F
- Service	-65° F to 200° F
Water Absorption after 14 days immersion:	Less than 5%
Chemical Resistance after 7 days immersion in 5% Potassium Hydroxide and 5% Hydrochloride Acid	Excellent
Resistance to Water and Organic Solvents	Excellent
Resistance to Shock, Heat, and Cold	Excellent
Color	Black
Shelf Life	Excellent
Elongation	
- Initial	30%
- 2 weeks at 190° 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° F

2.10 FLEXIBLE MANHOLE SEALS

- A. Flexible manhole seals shall be:
1. New Lok Joint Flexible Sleeve by Interpace,
 2. A-Lok Manhole Sleeve by L & L Concrete Products,
 3. Press Wedge II by Pre-Seal Basket Corporation,
 4. or approved equal.
- B. Field applied seals shall be similar to a style typified by Kor-N-Seal boot or an approved equal.
- C. Manhole sleeves, gaskets and sealants shall be furnished complete with lubricants, stainless steel stops, inserts, clamps, etc.

2.11 SOURCE QUALITY CONTROL

- A. Contractor will employ an independent testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.
 - 1. Allow Contractor's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- B. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements.
- C. Strength of precast concrete units will be considered deficient if units fail to comply with PCI MNL 116 requirements, including the following:
 - 1. Units fail to comply with compressive-strength test requirements.
 - 2. Reinforcement of units do not comply with fabrication requirements.
 - 3. Concrete curing and protection of units against extremes in temperature fail to comply with requirements.
 - 4. Units are damaged during handling and erecting.
- D. Testing: If there is evidence that the strength of precast concrete units may be deficient or may not comply with PCI MNL 16 requirements, Engineer may employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42.
 - 1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Engineer.
 - 2. Cores will be tested in an air-dry condition per ACI 301 if units will be dry under service conditions.
 - 3. Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is equal to at least 85 percent of the 28-day design compressive strength and no single core is less than 75% of the 28-day design compressive strength.
 - 4. Test results will be made in writing on the same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports will include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.

- c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit or units represented by core tests; design compressive strength; type of break; compressive strength at break, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Dimensional Tolerances: Units with dimensions smaller or larger than required and not complying with tolerance limits may be subject to additional testing.
- 1. Precast concrete units with dimensions larger than required will be rejected if the appearance or function of the structure is adversely affected or if larger dimensions interfere with other construction. Repair or remove and replace rejected units, as required, to comply with construction conditions.
- G. Defective Work: Precast concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.
- 1. Protect precast concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.

2. Repair damaged metal surfaces by cleaning and applying a coat of galvanized repair paint to galvanized surfaces.
- B. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units unless approved by Engineer.
 - C. Erection Tolerances: Install precast concrete units level, plumb, square, and true, without exceeding the recommended erection tolerances in PCI MNL 127, "Standards and Guidelines for the Erection of Precast Concrete Products".
 - D. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at keyways, connections, and joints as follows:
 1. Provide forms or other approved method to retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

3.3 FIELD QUALITY CONTROL

- A. Testing: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections.
- B. Field welds and connections using high-strength bolts will be subject to tests and inspections.
- C. Testing agency will report test results promptly and in writing to Contractor and Engineer.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.4 CLEANING

- A. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.
 1. Wash and rinse according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.

2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.

3.5 PROTECTION

- A. Adjacent surfaces shall be protected from damage during sealing and cleaning operations and against damage, disfiguration or discoloration from subsequent operations. Noncombustible shielding shall be used during welding operations.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 03410

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SECTION 05500

MISCELLANEOUS METALS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This Section includes the following:
 - 1. Furnishing, installing, and testing all miscellaneous metalwork and appurtenances complete in accordance with the Contract Documents.

1.2 RELATED TECHNICAL SECTIONS

- A. Section 01600 – PRODUCTS, MATERIALS, AND EQUIPMENT
- B. Section 02980 – SITE IMPROVEMENTS
- B. Section 03300 – CONCRETE
- C. Section 03315 – GROUT

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTALS:
 - 1. Show Drawings of all miscellaneous metalwork used in the Work showing materials, sizes, finishes, locations, attached hardware and fittings, and details for manufactured items and fabricated metalwork, including grating span charts, field erection details showing cuts, copes, connections, holds, thread fasteners and welds. Indicate welds, both shop and field, by symbols conforming to AWS standards. Indicate coatings or other protection against corrosion.
 - 2. Manufacturer’s literature describing standard items.
 - 3. Setting diagrams, erection plans, templates and directions for installing of backing plates and anchors.
 - 4. Statement stating that all materials, finishes and load requirements conform to the Contract Documents.
 - 5. Anchor Submittals
 - a. Submit an ICC-ES or IAPMO-UES report listing the ultimate load capacity in tension and shear for each size and type of concrete anchor.

- b. Submit an ICC-ES or IAPMO-UES report listing the ultimate load capacity in tension and shear for each size and type of concrete anchor.
- c. Upon review by the ENGINEER, these instructions shall be followed specifically.
- d. No substitution for the indicated anchors will be considered unless accompanied with an ICC-ES or IAPMO-UES report verifying strength and material equivalency.
- e. Complete structural calculations and anchorage details shall be prepared and submitted by the Contractor for all anchors and anchor groups that are shown but not completely detailed (type, size, location, spacing and embedment) on the Contract Documents. Calculations and anchorage details shall be signed and stamped by a Professional Engineer registered in the state in which the project is located.

1.4 QUALITY CONTROL

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified
 - 1. Welders Qualifications: All weld procedures and welder qualifications shall be available in the Contractor's field office for the Owner's review.
 - 2. All welding shall be inspected by a Contractor-provided inspector qualified in accordance with AWS requirements and approved by the Owner.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Steel:
 - 1. Wide Flange Shapes: ASTM A992
 - 2. Shapes, Plates, Bars: ASTM A36
 - 3. Pipe, Pipe Columns: ASTM A 53, Type E or S, Grade B Standard weight unless noted otherwise
 - 4. Tubes: ASTM A 500 Grade B

5. Unless otherwise indicated, miscellaneous metalwork of fabricated steel, which will be submerged shall be hot-dip galvanized after fabrication. All other miscellaneous steel metalwork shall be coated or protected from corrosion with a specified protective coating.
- B. Stainless Steel:
1. Unless otherwise indicated, stainless steel metalwork and bolts shall be of Type 316 stainless steel and shall not be galvanized.
 2. Shapes and Bars: ASTM S276
 3. Type (or Grade) 316L for Welding
- C. Aluminum: Unless otherwise indicated, aluminum metalwork shall be of Alloy 6061-T6. Aluminum in contact with concrete, masonry, wood, porous materials, or dissimilar metals shall have coated contact surfaces.
- D. Cast Iron: Unless otherwise indicated, iron castings shall conform to the requirements of ASTM A 48, Class 50B or better.
- E. Color Galvanized Steel Tube Railings:
1. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Interna-Rail System by Hollaender.
 - b. Blum, Julius & Co., Inc.
 - c. Pleasant Mount Welding Inc., Carbondale, PA 18407.
 - d. Or approved equal.
 - B. Source Limitations: Obtain each type of railing from single source from single manufacturer.
 - C. Provide and install following finishes and types of handrails and guardrails on the project:
 1. For exterior handrails and guardrails provide and install color galvanized steel handrails and guardrails using Colorgalv 10 finish by Duncan Galvanizing Corporation, Everett, MA or approved equal. Color galvanize wall brackets and base plates to be used to secure handrails and guardrails. Color to be selected by the Architect.

2.2 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 shall fit within their respective frames so that the cover fits flush with the surrounding finish surface and so that the cover does not rock or rattle when loading is applied. Covers and frames shall have machined bearing surfaces.
- C. Covers with matching frames shall be designed to support the following loadings:
 - 1. Where located within a structure, the design loading shall match that required for the adjacent floor area, or, if no loading is given, a minimum of 300 pounds per square foot, unless indicated otherwise.
 - 2. Exterior covers and grates shall be designed for AASHTO HS20 loading unless indicated otherwise.

2.3 BAR GRATES

- A. Provide bar grates as indicated and fabricated from hot dipped galvanized steel shapes and bars. Welded joints shall be ground smooth. Allow for gasketing and hardware as indicated.

2.4 BOLTS AND ANCHORS

- A. Corrosive Service: All bolts, nuts, and washers shall be Type 316 stainless steel for all areas indicated below.
 - 1. All buried locations.
 - 2. All submerged locations.
 - 3. All locations subject to seasonal or occasional flooding.
 - 4. Inside hydraulic structures below the top of the structure.
 - 5. Inside buried vaults, manholes, and structures which do not drain through a gravity sewer or to a sump with a pump.
 - 6. All locations subject to continuous or intermittent wetting or spraying other than weather.
 - 7. All locations indicated by the Contract Documents or designated by the Owner to be provided with stainless steel bolts.

- B. Non-Corrosive Service: All bolts nuts and washers used in locations not identified in Paragraph 2.4.A, shall satisfy the following.
1. All bolts, anchor bolts, nuts, and washers shall be Type 304 stainless steel, class 2, conforming to ASTM A 193 for bolts and to ASTM A 194 for nuts.
- C. Bolt Requirements:
1. The bolt and nut material shall be free-cutting steel.
 2. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.
 3. All bolts and nuts shall be installed with washers fabricated of material matching the base material of bolts, except that hardened washers for high strength bolts shall conform to the requirements of the AISC Specification. Lock washers shall be installed with washers where indicated and shall be fabricated of material matching the bolts.
 4. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 1/2-inch beyond the nut.
 5. All threads on stainless steel bolts shall be protected with an anti-seize lubricant, shall be classified as acceptable for potable water use by NSF and suitable for submerged stainless steel bolts, to meet government specification MIL-A-907E.
 6. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.
- D. Adhesive Anchors: Unless otherwise indicated, all drilled, concrete or masonry anchors shall be adhesive anchors. Any substitutions must be accompanied by an ICC-ES or IAPMP-UES report verifying strength and material equivalency.
1. Epoxy adhesive anchors are required for drilled anchors where exposed to weather, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring pumps and other equipment. Epoxy anchor grout shall comply with Section 03315 – GROUT. Threaded rod shall be Type 316 stainless steel.
- E. Expanding-Type Anchors: Expanding-type anchors, if indicated or permitted, shall be steel expansion type (lead caulking anchors will not be permitted) and the size indicated. Expansion type anchors which are to be embedded in grout may be steel. Non-embedded, buried, or submerged anchors shall be stainless steel. Expanding-type anchors shall be similar to a style typified by Kwik Bolt

TZ by Hilti Corporation, Strong-Tie Strong Bolt 2 by Simpson, Power-Stud+SD1 by Powers or an approved equal.

2.5 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a professional engineer registered in the State of Massachusetts.

B. Structural Performance: Railings and guardrails, including attachment to walls and floors, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

- a. Uniform load of 50 lbf/ ft. applied in any direction.
- b. Concentrated load of 200 lbf applied in any direction.
- c. Uniform and concentrated loads need not be assumed to act concurrently.
- d. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- e. Handrail components and installations to follow current ADA and IBC guidelines.
- f. Provide and install type of brackets with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.
- g. Provide exposed fasteners with finish matching appearance, including color and texture, of railings and brackets.

2. Infill of Guards:

- a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
- b. Infill load and other loads need not be assumed to act concurrently.

3. Temperature Change: 120 deg F, ambient; 180 deg F.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections and other detrimental effects.

2. Temperature Change: 120 deg F, ambient; 180 deg F.

PART 3 – EXECUTION

3.1 FABRICATION AND INSTALLATION REQUIREMENTS

- A. Fabrication and Erection: Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."
- B. Contractor to provide stamped shop drawing with calculations for handrail and guardrails by a structural engineer registered in the state of MA.

3.2 WELDING

- A. Method: All 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. Qualification of welders shall be in accordance with the AWS Standards governing same.
- B. Quality: In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as indicated by the AWS Code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

3.3 GALVANIZING

- A. All structural steel plates shapes, bars and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A 123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153.

3.4 DRILLED ANCHORS

- A. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dry. Drilled anchors shall not be installed until the concrete has reached the specified 28-day compressive strength. Adhesive

anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

- B. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes shall be adjusted to avoid drilling through or cutting any existing reinforcing bars.
- C. All abandoned drilled holes shall be filled with Epoxy Anchor Grout.

PART 4 – COMPENSATION (Not Used)

END OF SECTION 05500

SECTION 07160

BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Cold applied, cut-back (asbestos-free) bituminous dampproofing applied to the following surfaces:
 - a. Apply dampproofing to exterior below grade surfaces of new concrete walls and slabs.
 - b. Exterior, below-grade surfaces of all new manholes and drain structures.
 - c. Exterior, below-grade surfaces of other concrete items specified.
- B. Bituminous dampproofing can be factory applied, providing the application meets coating manufacturer's requirements. Additional field coatings must be applied, as directed by Engineer, to repair any coating imperfections, and chipped or damaged areas.

1.2 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTALS
 - 1. Product Data: For each type of product indicated.
 - 2. For informational purposes only, submit recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.
 - 3. Material Certificates signed by manufacturers.

1.3 QUALITY CONTROL

- A. Provide in accordance with Section 01400 – QUALITY CONTROL and as specified.
- B. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Provide in accordance with Section 01600 – PRODUCTS, MATERIALS AND EQUIPMENT.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.
- C. Allow a minimum of 48 hours for drying before backfilling, unless a greater drying period is recommended by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cold-Applied, Cut-Back (Solvent-Based) Bituminous Dampproofing shall be:
 - a. Karnak 83 AF by Karnak Corporation,
 - b. Sealmastic by Meadows, W. R., Inc.,
 - c. Waterban 50 by Lambert Corporation,
 - d. Or equal.

2.2 BITUMINOUS DAMPPROOFING (ASBESTOS-FREE)

- A. Cold-Applied, Cut-Back (Solvent-Based) Bituminous Dampproofing:
 - 1. Brush and Spray Coats: ASTM D 4479, Type I.
 - 2. Trowel Coats: ASTM D 4586, Type I.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
 - 1. Begin dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturers' written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
 - 1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated and shall be applied to subsequent coat(s).
 - 2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coat(s).
- B. Apply dampproofing to all exterior below grade concrete surfaces.
 - 1. For application on structures extending above grade, apply from finished-grade line down.

3.4 COLD-APPLIED, CUT-BACK ASPHALT DAMPPROOFING

- A. On all dampproofing applications: Apply two brush or spray coats at not less than 1.25 gallons/100 feet² for first coat and 1 gallons/100 feet² for second coat, or one trowel coat at not less than 4 gallons/100 feet².

3.5 CLEANING

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

PART 4 – COMPENSATION (NOT USED)

END OF SECTION 07160

SECTION 16135

ROADWAY LIGHTING INFRASTRUCTURE

16135.1	1-INCH ELECTRICAL CONDUIT (SINGLE) CONCRETE ENCASED (LIGHTING)	LINEAR FOOT
16135.2	2-INCH ELECTRICAL CONDUIT (SINGLE) CONCRETE ENCASED (LIGHTING)	LINEAR FOOT
16135.3	3-INCH ELECTRICAL CONDUIT (SINGLE) CONCRETE ENCASED (LIGHTING)	LINEAR FOOT
16135.4	ELECTRIC HANDHOLE (LIGHTING) – MUNICIPAL STANDARD	EACH
16135.5	LIGHT STANDARD FOUNDATION (STANDARD PRECAST)	EACH
16135.6	GROUND ROD 8-FT LONG	EACH
16135.7	ACORN LUMINAIRE AND POLE	EACH
16135.8	PENDANT LUMINAIRE AND POLE (1 AND 2 HEAD)	EACH
16135.9	CONTEMPORARY LUMINAIRE AND POLE	EACH
16135.10	STEEL POLE W/GFI RECEPTACLE	EACH
16135.11	REMOVE AND STACK EXISTING STREET LIGHT	EACH
16135.12	REMOVE AND RELOCATE EXISTING STREET LIGHT	EACH
16135.13	WIRE TYPE 7 NO. 10 GENERAL PURPOSE	LINEAR FOOT
16135.14	WIRE TYPE 7 NO. 4 GENERAL PURPOSE	LINEAR FOOT
16135.15	WIRE TYPE 7 NO. 6 GROUNDING AND BONDING	LINEAR FOOT
16135.16	WIRE TYPE 7 NO. 10 GROUNDING AND BONDING	LINEAR FOOT
16135.17	LIGHTING CONTROL EQUIPMENT	EACH
16135.18	STEEL POLE	EACH
16135.19	FESTOON STRING LIGHTING	LINEAR FOOT

PART 1 - GENERAL

1.1 Summary

- A. Work includes the furnishing and installation of street lighting fixtures and poles, removal and relocation of existing street lights, light pole foundations, conduit, handholes, and wiring at locations indicated in the Contract Documents. Conduits in sidewalks and roadways shall be concrete encased. Conduits in parks and conduits from handhole to pole base shall be direct buried. This work shall be performed in accordance with the Massachusetts Electrical Code and as required in the Contract Documents
- B. Work required to furnish and install handholes and light pole foundations for lighting shall be in accordance with Section 801 of the Mass DOT Standard Specifications and as required in the Contract Documents.
- C. Work required to furnish and install ground rods and wiring shall conform to the requirements of Section 813 of the Mass DOT Standard Specifications and as required in the Contract Documents.
- D. Conduits between lighting control enclosures or utility manhole to electric hand holes or lighting control enclosures shall be 4 inches.
- E. Conduits between hand holes and light bases or receptacles shall be 2 inches, or as indicated on the drawings.

PART 2 - PRODUCTS

2.1 Electric Conduit

- A. 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.
- B. Concrete for encasement shall be 3,000 psi / 3/8 inch / 565 per MassDOT Standards.

2.2 Handholes

- A. Precast handhole units for lighting shall be 12"W x 24"L x 20" D and shall otherwise meet the requirements of The City of Cambridge and Mass DOT Standard Specifications Section M4.02.14. Covers shall be clearly marked "LIGHTING".

2.3 Light Foundations (Standard Precast)

- A. Precast units shall meet the requirements of Mass DOT Standard Specifications Section M4.02.14.
- B. Steel reinforcing bars shall be deformed bars rolled from new billet steel conforming to the requirements of ASTM A615, Grade 60.

- C. The Contractor shall provide 2” rigid galvanized steel conduit to stub out of base.
- D. Anchor bolts for installation of light pole per manufacturer’s recommendations.

2.4 Lamp Posts and Luminaires

- A. Light poles, arms and luminaires shall match the City of Cambridge standards and specifications.
- B. Contractor shall furnish and install all lamp posts and luminaires as indicated and as specified on the drawings.
- C. A weather resistant GFCI duplex receptacle shall be factory-installed on pole where indicated on the drawings. The duplex GFI receptacle shall be a ground fault circuit interrupting type, full gang size, polarized, duplex, parallel blade, U grounding slot, specification grade, rated at 20 amperes, 125 Vac and have screw terminals (use of push-in terminals is not acceptable). Receptacle cover plate shall be weatherproof in-use cover with NEMA 3R with cord in place spring-loaded cast aluminum cover door that meets current MEC standards. Receptacle shall be supplied from the factory with a quick-disconnect connector at the receptacle and shall have sufficient length of wire to reach 18" out of handhole in pole base (provided by contractor).

2.5 Ground Rod

- A. An 8 foot long, 3/4 inch copper-clad ground rod shall be provided for all light control enclosures, light fixture foundations and handholes. The minimum size grounding conductor shall be No. 4 AWG with an approved type connection at each ground rod and light fixture foundation. 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 foundation. This connection will be made with an exothermic weld.

2.6 Wiring

- A. The minimum size wire from the circuit breaker to all hand holes shall be Three (3) No.4 A.W.G. type THHN copper. 1 Black, 1 White and 1 No.4 A.W.G. THHN copper. Green for grounding conductor
- B. 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
- C. 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
- D. 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.
- E. Wires shall be continuous where practicable and where splices are made pressure connectors

suitable for the purpose shall be used.

2.7 Lighting Control Equipment

- A. The astronomic timer switch shall be rated 125 VAC, 1- pole, 20 Amp and be manufactured by Tork, Paragon or equal.
- B. The photocell shall be rated 125 VAC, 20 Amp and be manufactured by TORK or equal.

PART 3 - EXECUTION

3.1 Electrical Conduit

- A. The Perimeter of the paved area to be removed for conduit installation shall be sawcut.
- B. 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.
- C. 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 personnel who may be involved in future excavations that electrical 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.
- D. 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.
- E. All conduits shall be free of foreign materials prior to the installation of conductors
- F. A polypropylene or nylon pull rope shall be installed in all empty conduits.
- G. Conduits shall be sealed after installation, prior to placing concrete encasement and installing conductors.

3.2 Handhole

- A. 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 at or near each proposed light installation.
- B. 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.

3.3 Light Standard Foundation (Precast)

- A. 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.
- B. Contractor to coordinate with the City of Cambridge Electrical Department for type of anchor bolts to be used for securing the existing light poles to the precast foundations.
- C. All foundations will be set plumb and true to grade.
- D. 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 these locations. 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.
- E. 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.
- F. 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.
- G. 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.
- H. 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 with the approval of the Engineer.
- I. 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 curved curb, the bolts may be adjusted with the approval of the Engineer to allow proper placement of the pole when installed.

3.4 Installation of Lighting Fixtures

- A. Furnish and install a complete lighting system, including conduit, wire, outlet boxes, lighting fixtures with lamps, receptacles, and switches as required.

- B. Where job conditions require locations different from those shown to avoid equipment, etc., such changes shall be made without additional cost to the Owner.
- C. All fixtures shall be furnished complete with sockets, wiring, trims, hangers, frames, lamps, etc.
- D. Each streetlight pole shall be provided with its own separate ground rod adjacent to its foundation and bonded to the pole's grounding lug as shown on the Drawings. Install luminaires with the correct optical system orientation, socket position and inclination angle to meet the specified photometric requirements. Align luminaires vertical and perpendicular (or tangent) to the centerline of the street, install new lamps, and clean luminaire components of all construction dirt and dust and fingerprints prior to final completion.
- E. Handle lighting fixtures carefully to prevent breakage, denting or scoring of fixtures' finishes. Do not install damaged lighting fixtures. Replace with undamaged units and return damaged units to equipment manufacturer. Install luminaire, fusing and wiring complete. Install a wattage identification sticker inside the pole handhole. No other identifying numbers except the manufacturer's nameplate shall be installed on the poles or arms or luminaries.
- F. Splices and junctions shall be made only in pole handholes and underground handhole junction boxes. Perform no more splices than needed. Do not splice or junction any wires that continue through a pole or junction box, in other words, those conductors without a termination to the adjacent pole. Use Junction box as a pulling point only. Cable pulled through poles or junction boxes shall be marked per the following paragraph and shall have sufficient loop to extend 18" beyond handhole or junction box lid for future maintenance but shall not be spliced. All splices in junction boxes shall be made waterproof by a UL listed heat shrink splice cover. All splices and junctions shall be considered incidental to the pay item.
- G. Install a tie wrap type permanent wire marker on each and every pair of conductors passing through every junction box or pole handhole (bundle circuit pairs together). Mark controller number, circuit letter and pole number on each tie wrap and designate home runs as encountered. Install markers in each pole handhole.

3.5 Ground Rod

- A. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

3.6 Wiring

- A. The Contractor shall be required to furnish and install all materials, equipment and labor necessary to completely wire and operate the street lighting system. All materials and wiring procedures shall conform to the specifications contained herein and to the requirements and standard practices of the Section 800 and the following:

All wire and connectors shall conform to the standards of the National Electrical Manufacturers Association or the Underwriters' Laboratories, Inc., whichever is applicable. All materials and workmanship shall conform to the requirements of the Mass Electrical Code, Standards of the American Society for Testing and Materials, and any local ordinances that may apply. Wherever any reference is made to the standards mentioned above, the reference should be construed to

mean the standard that is in effect on the day the Notice to Proceed to the Contractor for the work is dated. Wire sizes shall be based on American Wire Gage (AWG), as applied to copper conductors.

- B. 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.
- C. No wire shall be drawn in to any conduit until all work that may cause damage to the wire is complete.
- D. All wire terminals, taps and splices shall be made secure with connectors, splicing materials and methods as hereinafter specified.
- E. All incoming wires and outgoing wires in lighting load centers, handholes and poles shall be banded as indicated on the contract drawings.

3.7 Grounding

- A. Coatings and rust on conduits and grounding rods shall be removed at the location where the ground fittings are to be installed.
- B. The bare copper conductor shall be connected to the continuous insulated bonding lead, which shall be identified with green plastic marking tape as noted in the specifications. Bonding leads for lighting fixtures on poles shall be an insulated #10 AWG, marked green, which shall be extended to the nearest handhole and interconnected to the bare copper ground wire in the handhole of gauge shown on the contract drawings and the pig tail conductor shall be connected to the ground rod. The ground wire shall also connect to the ground lug on the handhole frame and be bonded to the handhole cover.
- C. A conductor with the same insulation of the power leads shall be installed in all conduits as a continuous bond wire. All bonding leads from fixtures, pole, control boxes, fittings and ground rods shall be connected to the continuous insulated bonding lead which shall be identified with green plastic marking tape as noted in the specifications.
- D. All grounding shall conform to the applicable provisions of the National Electrical Code.
- E. Field Tests
 - 1. Upon the completion of each wiring system, and before any connection is made to operating equipment, the Contractor shall perform, in the presence of the Engineer, the following tests of each circuit to determine whether the installations are in acceptable working order.
 - a. Tests for continuity
 - b. Tests for ground
 - c. Tests for insulation resistance (Megger Test) from circuit wires to ground, and between

circuit wires.

2. Tests for ground shall be performed in accordance with the relevant provisions of Section 813 of the Standard Specifications. The entire electrical wiring system shall be tested for continuity, grounds, resistance to ground, insulation, shorts and opens. This shall be done by means of a megohm meter test.
3. After installation of the wiring system is complete with the required splices, the lamp ballast primary shall be disconnected and each circuit shall be tested with a 1000 volt megger. Tests on each circuit shall be between each conductor. When the measured value is less than 200 megohms between two conductors, the Contractor shall locate the point or points at fault, make proper corrections, and then demonstrate by further test the elimination of such faults.
4. These tests shall be performed in the presence of the Engineer.
5. The test results shall be submitted to the Engineer for review and approval. If any results are questionable or inconsistent, the Contractor shall repeat the tests and make any necessary corrections at the request of the Engineer. No wiring system will be accepted until these are satisfactorily performed and approved.
6. The Contractor shall furnish the Engineer with a report of the megohm-meter readings for a permanent project record.
7. All tests and any necessary repairs or replacements that are indicated by the Engineer to produce a fault-free system will be performed at the Contractor's expense.

F. Warranties

1. The Contractor shall provide a performance warranty for six months on the entire work performed under this contract including the performance of all equipment and components of the roadway lighting system specified. The performance warranty responsibility of the contractor shall commence after official acceptance by the city of Cambridge or the Engineer.
2. NOTE: The Contractor shall be completely responsible for all maintenance, repairs and replacement of damaged equipment during the functional test and throughout the performance warranty period.
3. If within 48 hours after notification by the Engineer of a malfunction, and the Contractor fails to make such repairs as necessary, the Engineer will undertake repairs of which all costs are to be SS-113 borne by the Contractor. The cost of any maintenance necessary, except electrical energy, shall be at the Contractor's expense and will be considered as included in the price paid for the contract item involved and no additional compensation will be allowed therefore.

3.7 Remove and Relocate Existing Street Light

- A. Removal of existing street light, heads, poles and their accessories shall be done in a manner that will not damage the material.
- B. Poles and bases shall be separated from one another without damage to either unit. The shaft

shall be unscrewed from base.

- C. Underground foundations, and other materials not reused shall be removed and properly disposed of.
- D. Any damages to the street lights that are to remain operational shall be fully restored at no additional cost to the Owner.
- E. Anchor bolt installation per manufacturer's recommendations
- F. The Contractor shall exercise extreme caution when working near existing trees. The Contractor shall exercise extreme caution when removing and stacking the existing luminaires so as not to damage them.

3.8 Removal and Disposal of Existing Light Fixtures

- A. The Contractor shall coordinate with City of Cambridge before starting any work. The work shall include disconnecting wiring, removing and stacking of luminaires at the Town's DPW Yard, removal and disposal of poles, foundations, conduit and hand holes no longer required for proposed installations, and repairing the disturbed area to match surrounding surfaces. In special case, the existing foundation and the like can be left in place, as approved by the Engineer. The Contractor shall exercise extreme caution when working near existing trees. The Contractor shall exercise extreme caution when removing and stacking the existing luminaires so as not to damage them.

3.9 Lighting Control Equipment

- A. Furnish and install all control wiring and devices, complete with all accessories as indicated on the Drawings and as specified hereunder. All control devices shall be the product of a single manufacturer except where specifically stated otherwise.
- B. Lighting control equipment such as photocells, timers, circuit breakers shall be furnished and installed in existing lighting control cabinets to control the lighting as shown on the Drawings.

PART 4 – COMPENSATION

Item 16135.1 1-Inch Electric Conduit (Single) Concrete Encased (Lighting)

Item 16135.2 2-Inch Electric Conduit (Single) Concrete Encased (Lighting)

Item 16135.3 3-Inch Electric Conduit (Single) Concrete Encased (Lighting)

METHOD OF MEASUREMENT:

Measurement for payment for Items 16135.1 through 16135.3 will be based on the linear foot of conduit installed as indicated in the Contract Documents or as otherwise required by the Engineer.

BASIS OF PAYMENT:

Payment for work under Items 16135.1 through 16135.3 will be based on the unit price bid for this item in the proposal and shall include full compensation for all labor, materials, equipment, and any other incidental costs necessary for the satisfactory completion of this work including but not limited to removal and disposal of the existing conduit within limits of trench; abandonment of existing conduit and wiring; saw cutting the roadway and/or sidewalk; excavation of existing pavement and gravel in roadway

areas and asphalt, brick and concrete sidewalk pavements; disposal of construction debris (existing sidewalk, concrete, brick, asphalt, etc.), compaction and backfilling with suitable fill, furnish and install conduit, formwork and concrete for concrete encasement; and all other work not included for payment elsewhere.

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.

Item 16135.4 Electric Handhole (Lighting) – Municipal Standard

METHOD OF MEASUREMENT:

Item No. 16135.4 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.

BASIS OF PAYMENT:

Payment for work under these items shall constitute full compensation for sawcutting; excavation of existing pavement and gravel in roadway areas and asphalt, brick and concrete sidewalk pavements; disposal of construction debris (existing sidewalk, concrete, brick, asphalt, etc.), compaction and backfilling with suitable fill, furnish and install handhole and appurtenances; removal of existing handhole and conduit, and all other work not included for payment elsewhere.

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.

Item 16135.5 Light Standard Foundation (Standard Precast)

METHOD OF MEASUREMENT: Item No. 16135.5, 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.

BASIS OF PAYMENT:

Payment for work under these items shall constitute full compensation for sawcutting; excavation of existing pavement and gravel in roadway areas and asphalt, brick and concrete sidewalk pavements; disposal of construction debris (existing sidewalk, concrete, brick, asphalt, etc.), compaction and backfilling with suitable fill, furnish and install precast foundation, and all other work not included for payment elsewhere.

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.

Item 16135.6 Ground Rod – 8-FT Long

METHOD OF MEASUREMENT:

Measurement for payment for Item 16135.6 will be based on each ground rod installed as indicated in the Contract Documents or as otherwise required by the Engineer.

BASIS OF PAYMENT:

Payment for work under Items 16135.6 will be based on the unit price bid for this item in the proposal and shall include full compensation for all labor, materials, tools, equipment, and any other incidental costs necessary for the satisfactory completion of this work including; and all other work not included for payment elsewhere.

Item 16135.7 Acorn Luminaire and Pole

Item 16135.8 Pendant Luminaire and Pole (1 and 2 Head)

Item 16135.9 Contemporary Luminaire and Pole

Item 16135.10 Steel Pole w/ GFI Receptacle

Item 16135.18 Steel Pole

METHOD OF MEASUREMENT:

Measurement for payment for Items 16135.7 through 16135.10 will be based on each Light assembly installed as indicated in the Contract Documents or as otherwise required by the Engineer.

BASIS OF PAYMENT:

This work shall be measured for payment for each Item, installed, wired and lamped in place, which price shall include all materials, labor, and equipment for a complete and accepted installation.

Item 16135.11 Remove and Stack Existing Street Light

METHOD OF MEASUREMENT:

The Contractor shall coordinate with City of Cambridge before starting any work. The work shall include disconnecting wiring, removing and stacking of luminaires at the City's DPW Yard, removal and disposal of poles, foundations, conduit and hand holes no longer required for proposed installations, and repairing the disturbed area to match surrounding surfaces. In special case, the existing foundation and the like can be left in place, as approved by the Engineer.

BASIS OF PAYMENT:

Payment for work under this Item shall be at the Contract Unit Price bid per Each, which price shall constitute full compensation for the complete removal of existing street lights, any charges for disconnection. Luminaires shall be removed and stacked. Poles and other items of the existing light system shall be removed and discarded.

Item 16135.12 Remove and Relocate Existing Street Light

METHOD OF MEASUREMENT:

Measurement for payment for Remove and Relocate Existing Street Light will be based on the each street light removed and relocated as indicated in the Contract Documents or as otherwise required by the Engineer.

BASIS OF PAYMENT:

Payment for work under Remove and Relocate Existing Street Light will be based on the unit price bid for this item in the proposal and shall include full compensation for all labor, materials, equipment, and any other incidental costs necessary for the satisfactory completion of this work including but not limited to disconnecting the street light from the foundation; the removal of the existing signal head from the existing pole as necessary; disconnect power, wiring and meter; remove, transport and stockpile the

existing signal pole and head and meter; transport; protect the existing pole and head; furnish and install wiring to reconnect signal to overhead electric; removal and disposal of the existing foundation,; all connections of wiring to existing power sources and to the relocated pole; transport the pole and light head from the stockpile area back to the site; installation of the pole onto the base including all hardware; reinstallation of the head onto the existing pole including all hardware; furnish and install new bulbs; and all other work not included for payment elsewhere.

Item 16135.13 Wire Type 7 No. 10 General Purpose

Item 16135.14 Wire Type 7 No. 4 General Purpose

Item 16135.15 Wire Type 7 No. 6 Grounding and Bonding

Item 16135.16 Wire Type 7 No. 10 Grounding and Bonding

METHOD OF MEASUREMENT:

Measurement for payment for Items 16135.13 through 16135.16 will be based on the linear foot of wiring installed as indicated in the Contract Documents or as otherwise required by the Engineer.

BASIS OF PAYMENT:

Payment for work under Items 16135.13 to 16135.16 will be based on the unit price bid for this item in the proposal and shall include full compensation for all labor, materials, tools, equipment, and any other incidental costs necessary for the satisfactory completion of this work including; installation of wire and cable runs; splices with compression type fittings; installation of circuit breakers; and all other work not included for payment elsewhere.

Item 16135.17 Lighting Control Equipment

METHOD OF MEASUREMENT:

Measurement for payment for Items 16135.17 will be based on the each control item installed as indicated in the Contract Documents or as otherwise required by the Engineer.

BASIS OF PAYMENT:

Payment for work under Items 16135.17 will be based on the unit price bid for this item in the proposal and shall include full compensation for all labor, materials, tools, equipment, and any other incidental costs necessary for the satisfactory completion of this work including; installation of wire and cable runs; splices with compression type fittings; installation of circuit breakers; and all other work not included for payment elsewhere.

Item 16135.19 Festoon String Lighting

METHOD OF MEASUREMENT:

Measurement for payment for Items 16135.19 will be based on linear feet of Festoon String Lighting installed as indicated in the Contract Documents or as otherwise required by the Engineer.

BASIS OF PAYMENT:

This work shall be measured for payment by linear feet of string lighting installed, carrier cable installed and tensioned, carrier cable connected to steel poles, wired and lamped in place, which price shall include all materials, labor, and equipment for a complete and accepted installation.

END OF SECTION 16135

APPENDIX A
OIL AND HAZARDOUS MATERIALS FINDINGS AND SOIL MANAGEMENT
RECOMMENDATIONS



KLEINFELDER MEMORANDUM

TO: Christine Clancy, P.E., Kleinfelder
FROM: Tyler Bernier, Kleinfelder
DATE: September 5, 2017
SUBJECT: **Oil and Hazardous Materials Findings and Soil Management Recommendations, Inman Square Intersection Safety Improvements, Cambridge, Massachusetts**
File No. **20170208.005A**

INTRODUCTION

This memorandum presents the results of Kleinfelder's preliminary assessment of environmental conditions in the Inman Square Intersection Safety Improvements Project area in Cambridge, MA. The project area is centered on the intersection of Cambridge Street with Hampshire Street, and includes portions of Springfield Street, Inman Street, and Antrim Street that abut the Inman Square intersection. The project consists of the redesign of the Inman Square intersection to reduce vehicle and pedestrian wait times and improve the safety of the intersection for all transportation modes. Restructuring the intersection will require the installation of traffic signal masts, and the reconstruction of sidewalks and streets on Hampshire Street, Cambridge Street, Antrim Street, Inman Street and Springfield Street. Project limits are provided on Figure 1 – Site Plan, attached.

This assessment includes a review of the Massachusetts Department of Environmental Protection (MassDEP) searchable Sites database; a site reconnaissance; and, subsurface soil sampling and analysis in the above-cited area. This memorandum also provides guidance on state and federal requirements for soil management, based on the results of the laboratory chemical analyses.

FINDINGS

Kleinfelder completed a reconnaissance of the project area using aerial photographs and a site visit. The Inman Square Project Area is a mixture of residential buildings and commercial properties. The Inman Square Fire House, an active fire station, is located between Inman Street and Antrim Street on Cambridge Street. An open space area known as Vellucci Plaza is located on the west side of the Inman Square intersection. The surrounding neighborhood is occupied primarily by residences.



A database search was conducted using the MassDEP Site database. No MassDEP releases, as defined in 310 CMR 40.0000, the Massachusetts Contingency Plan (MCP), were identified within the project area. One location, at 1310 Cambridge Street, was identified just beyond the eastern extent of project area as a location where a release of oil or hazardous material (OHM) to the environment has occurred.

Release Tracking Number (RTN) 3-00950, is associated with the East Cambridge Savings Bank at 1301 Cambridge Street. In 1987, a 4,000-gallon buried fuel oil tank was removed from the site when it was discovered during construction activities associated with the expansion of the East Cambridge Savings Bank building. Numerous holes were observed in the tank at the time of removal and soil in the vicinity of the tank was observed to be contaminated by fuel oil. Additionally, oil as a light non-aqueous phase liquid (LNAPL) was observed on groundwater within the excavation. Under the direction of Geotechnical Engineers, Inc. (GEI) and the MassDEP, impacted soil and groundwater was removed by Clean Harbors, Inc. at the time the tank was discovered. On March 5, 1987, MassDEP personnel recommended that the excavation be terminated due to unsafe conditions. At the time the excavation was terminated, GEI noted impacted soil remaining along the north and east sides of the excavation near Cambridge Street. Between February 27 and March 4, 1987, approximately 224 cubic yards of contaminated soil and 975 gallons of contaminated groundwater were reported to have been removed from the Site.

In March 1987, GEI conducted a subsurface exploration program to characterize the nature and extent of contamination at the site. Volatile organic compounds (VOCs) and Oil and Grease, were detected in groundwater. Soil samples were not collected during the March 1987 subsurface investigation.

In June 1994, GEI advanced a single soil boring and installed a monitoring well at the location of the former UST. Subsequently, on July 21, 1994, GEI submitted a Licensed Site Professional Evaluation Opinion Transmittal form stating that no further actions were required. The MassDEP Site database lists RTN 3-00950 as closed site. However, Kleinfelder's review of the files in the MassDEP database suggests that petroleum contaminated soils remained in place on the northern wall of the excavation and that the extent of contamination was not delineated to the north, within Cambridge Street. As such, the potential exists for petroleum contaminated soils associated with RTN 3-00950 to extend beyond the northern property boundary into the Cambridge Street right-of-way (ROW).

Other than as noted above, the results of the state database search did not identify releases within or adjacent to the project area that could impact construction operations in the area.



SUBSURFACE INVESTIGATION

In August 2017, Geologic Earth Exploration, Inc. of Norfolk, Massachusetts, advanced three (3) soil borings, designated B-1 through B-3, within the project area. Advancement of the borings was observed by a Kleinfelder's geotechnical/environmental professional. The borings were drilled to a depth of 21-feet below the ground surface (bgs). All borings were advanced within the ROW of public roadways. A groundwater monitoring well was installed in boring B-1. The test borings were advanced using drive and wash methods to the indicated depth. A standard split-spoon sampler, 24 inches long, was used to obtain soil samples beginning below the existing asphalt roadway, continuously through the fill layer, and then every five feet from the bottom of the fill layer to the bottom of the boring for visual classification. Boring logs (attached) were prepared by Kleinfelder.

The locations of the borings are provided on Figure 1- Site Plan.

Subsurface Soil and Groundwater Conditions

Soil

Boring B-1: Granite cobblestone pavers were observed immediately below the roadway asphalt surface, followed by fill material consisting of gray to brown sandy clay and sandy silt with varying amounts of cobblestone, brick, wood, and asphalt particles throughout. Fill material was observed in B-1 to a depth of 12.5 feet bgs. Below the fill material was a natural deposit of gray medium-plasticity clay.

Boring B-2: Gray to brown, well graded sand and gravel fill material was observed immediately below the roadway asphalt surface. Varying amounts of brick and asphalt particles were observed within the fill to approximately 6 feet bgs. Fill material was observed in B-2 to a depth of 9 feet bgs. Below the fill material was a natural deposit of light gray to light brownish gray silt and clay.

Boring B-3: Olive gray to olive brown sandy silt and clayey sand fill material was observed immediately below the roadway asphalt surface. Brick, glass, and asphalt particles were observed from approximately 5 to 15 feet bgs. Fill material was observed in B-3 to a depth of 15 feet bgs. Below the fill material was a natural deposit of olive brown to light gray silt and clay.

In each boring, soil collected from 0 to 6 feet bgs was screened for VOCs using a photo-ionization detector (PID). PID readings ranged from non-detect to 4.8 parts per million by volume (ppmv). No petroleum or chemical odor or staining was observed in soil recovered from the soil borings.

Groundwater

As part of the drive and wash drilling process, water is introduced to the boring as it is advanced. As a result, observation of groundwater levels is not made in the field at the



time of drilling. A monitoring well was installed in boring B-1 in order to obtain the groundwater elevation at a later date. Groundwater at the location of B-1 was measured at 7.62 feet bgs. No odor was detected in groundwater during drilling or subsequent gauging. No groundwater samples have been collected to-date.

Laboratory Analytical Program

During the boring program, a single composite sample was collected by compositing soil from the fill layers in borings B-1, B-2, and B-3. The composite sample is intended to be representative of the fill material across the entire project area. Three grab samples, one from each boring, were collected for VOC analysis. Grab samples submitted for VOC analysis were collected from the sample with the highest PID reading in each boring.

Samples were submitted to Con-Test Analytical Laboratory (Con-Test) of East Longmeadow, Massachusetts for laboratory chemical analysis. The composite fill sample "IS_B-1-2-3" was analyzed for MCP 14 metals, semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), total petroleum hydrocarbons, conductivity, ignitability, and reactivity. The grab sample collected from each boring was analyzed only for VOCs.

The results of each analysis were compared with MCP Reportable Concentrations. RCS-1 soil Reportable Concentration limits apply to locations at or within 500 feet of a residential dwelling, a residentially-zoned property, school, playground, recreational area or park; or within the geographic boundaries of a groundwater resource area categorized as RCGW-1 in 310 CMR 40.0362(1)(a). RCS-2 limits apply to all soil samples that are not obtained from category RCS-1 areas. Based on observed property uses and a review of City zoning, RCS-1 Reportable Concentrations apply to the project area. A summary of the chemical analyses is attached as Table 1- Soil Analytical Results.

Metals

Barium, cadmium, chromium, nickel, vanadium, zinc, and mercury were detected at concentrations above laboratory reporting limits but below the RCS-1 thresholds in the composite sample "IS_B-1-2-3". Lead was detected at a concentration of 670 mg/kg, above the RCS-1 threshold of 200 mg/kg and the MassDEP-published background concentration of 600 mg/kg in "IS_B-1-2-3". No other metals were detected above laboratory reporting limits.

VOCs

Naphthalene was detected at a concentration of 18 mg/kg, above the RCS-1 threshold of 4 mg/kg in sample "B-1_0-1". No other VOCs were detected above laboratory reporting limits or at concentrations exceeding RCS-1 limits. The total VOC concentration at B-1 (18 mg/kg) exceeds the lined and unlined landfill acceptance criteria of 10 mg/kg. No other VOCs were detected above laboratory reporting limits (LRL) or at concentrations



exceeding RCS-1 limits. Kleinfelder notes that the laboratory reporting limits for 24 of the remaining VOCs were above the RCS-1 thresholds in sample "B-1_0-1". These VOC analytes may be present in the area of boring B-1 at concentrations less than the elevated LRL but above RCS-1 thresholds; however, based on the PID results this is not considered likely. VOCs were not detected in B-2 or B-3.

SVOCs

In sample "IS_B-1-2-3", benzo(g,h,i)perylene, naphthalene, phenanthrene, and pyrene were detected at concentrations above laboratory reporting limits but below RCS-1 thresholds. The total SVOC concentration (4.31 mg/kg) is below the in-state landfill acceptance criteria of 100 ppm total SVOCs. No other SVOCs were detected above laboratory reporting limits.

Total Petroleum Hydrocarbons

Petroleum hydrocarbons were detected above laboratory reporting limits but below RCS-1 thresholds in sample "IS_B-1-2-3".

Other Analytes

No other analytes were detected above laboratory reporting limits or at concentrations exceeding RCS-1 thresholds.

CONCLUSIONS AND RECOMMENDATIONS

- Based on the findings presented in this Memorandum, soil in the Inman Square intersection project area has been impacted by OHM. While the source(s) of these impacts are not known, they are likely associated with historical fill placement, typical discharges from automobile operations and parking and/or from atmospheric deposition.
- Exceedance of the RCS-1 threshold for lead was identified in the composite sample, "IS_B-1-2-3". Additionally, the soil analyses indicated an exceedance of the RCS-1 threshold in sample "B-1_0-1" for naphthalene. Both samples were collected within the ROW of Cambridge Street. No visual or olfactory evidence of OHM was observed. The elevated lead and naphthalene is likely due to materials present in the fill and not representative of a release from a single source. However, soils impacted by OHM at concentrations exceeding RCS-1 limits should be anticipated to be present throughout the project area. Accordingly, management of soils in the vicinity of these borings will likely require submittal of a URAM Plan to MassDEP. Kleinfelder recommends that a URAM Plan be prepared and submitted to MassDEP prior to or at the start of construction to minimize the potential for schedule impacts.



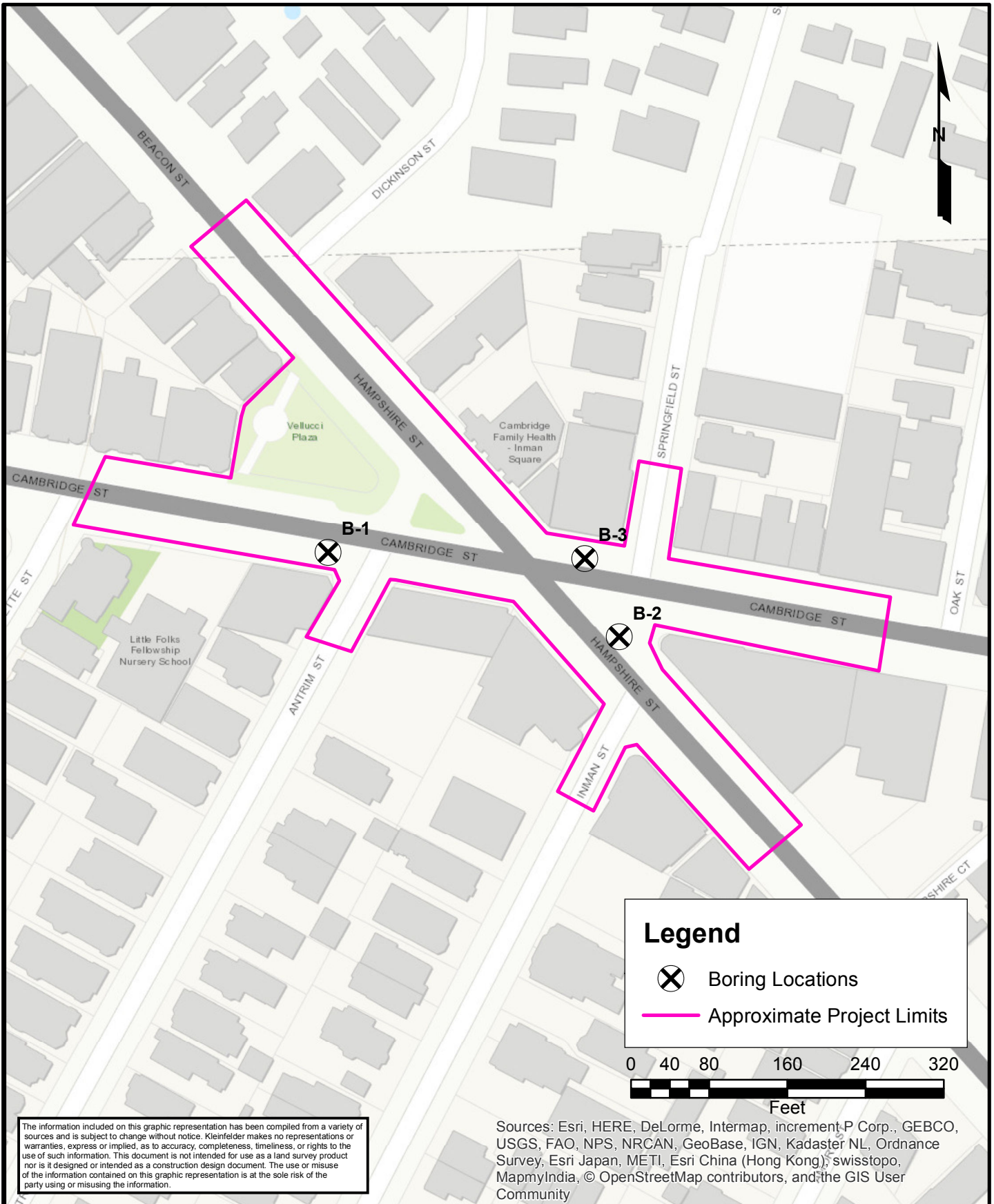
- Excavated soil should be reused in the area from which it was excavated to the extent that it is geotechnically suitable and consistent with project plans. Excavated soil that cannot be reused shall require laboratory analysis for disposal characterization parameters. Analytical results obtained to-date are variable, and indicate that fill in the project area is heterogeneous. The results of the grab sample collected from B-1 indicate that the soil in that area exceeds in-state landfill disposal limits and would need to be disposed of out of state or at an asphalt batch recycling facility. Soil from the vicinity of borings B-2 and B-3 is anticipated to be suitable for use as daily cover at an unlined landfill. If future disposal characterization results indicate that material from within the project area is suitable for reuse at a <RCS-1 managed fill facility, Kleinfelder recommends that only those facilities with a valid permit or Administrative Consent Order (ACO) issued by MassDEP be utilized.
- Contamination has not been identified and is not anticipated at any locations beneath the observed fill layer. If visual, olfactory or laboratory data evidence of OHM is encountered below the fill layer during the course of construction, Kleinfelder recommends that a Kleinfelder Licensed Site Professional (LSP) or his/her designee assess soil conditions to determine appropriate soil management and regulatory requirements and responses.
- If construction dewatering is anticipated, Kleinfelder recommends that on-site re-infiltration be utilized to the extent feasible. If discharge to the storm and/or municipal sewer system is anticipated, Kleinfelder recommends that representative groundwater samples be collected to determine which discharge permit will be required. The analytical parameters should be based on the National Pollution Discharge Elimination System (NPDES) or Massachusetts Water Resources Authority (MWRA) permit requirements, as applicable.

ATTACHMENTS

Figure 1 – Site Plan

Table 1 – Soil Analytical Results

Appendix A – Boring Logs



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.


 <p>KLEINFELDER Bright People. Right Solutions. www.kleinfelder.com</p>	PROJECT NO. 20170208.005A	Site Plan	FIGURE 1
	DRAWN: 8/23/17		
	DRAWN BY: TJB	INMAN SQUARE INTERSECTION SAFETY IMPROVEMENTS CAMBRIDGE, MASSACHUSETTS	
	CHECKED BY: RKQ		
FILE NAME: InmanSquareFig1			

TABLE 1
SOIL ANALYTICAL RESULTS
INMAN SQUARE INTERSECTION IMPROVEMENTS
CAMBRIDGE, MA

Parameter	Reportable Concentrations (RCs)			Comm 97 Contaminant Levels for Soil Reuse			MCP - Method 1 Cleanup Standards			SAMPLING LOCATION			
	RCS-1	Lined Landfill	Unlined Landfill	S-1/GW-2	S-2/GW-2	S-3/GW-2	B-1_0-1'	B-2_1-2'	B-3_3-4'	IS_B-1-2-3			
Sampling Date							8/10/2017	8/9/2017	8/9/2017	8/10/2017			
Sample Depth							0-1 Feet	1-2 Feet	3-4 Feet	2-3 Feet			
General Chemistry													
% Solids (%)	-	-	-	-	-	-	76.5	76.5	76.5	76.5			
SPECIFIC CONDUCTANCE (umhos/cm)	-	8000	4000	-	-	-	NT	NT	NT	47			
IGNITABILITY	-	-	-	-	-	-	NT	NT	NT	Absent			
REACTIVE SULFIDE (mg/kg)	-	-	-	-	-	-	NT	NT	NT	ND (20)			
REACTIVE CYANIDE (mg/kg)	-	-	-	-	-	-	NT	NT	NT	ND (4.0)			
Metals by SW-846 6010C-D (mg/Kg)													
BARIUM	1000	-	-	1000	3000	5000	NT	NT	NT	70			
CADMIUM	70	80	30	70	100	100	NT	NT	NT	1.0			
CHROMIUM	100	1000	1000	100	200	200	NT	NT	NT	31			
LEAD	200	2000	1000	200	600	600	NT	NT	NT	670			
NICKEL	600	-	-	600	1000	1000	NT	NT	NT	22			
VANADIUM	400	-	-	400	700	700	NT	NT	NT	38			
ZINC	1000	-	-	1000	3000	5000	NT	NT	NT	96			
MERCURY	20	10	10	20	30	30	NT	NT	NT	0.15			
VOCs by SW-846 8260C (mg/Kg)													
ACETONE	6	-	-	50	50	50	ND (19) *	ND (0.048)	ND (0.040)	NT			
BROMODICHLOROMETHANE	0.1	-	-	0.1	0.1	0.1	ND (0.37) *	ND (0.00097)	ND (0.00081)	NT			
BROMOFORM	0.1	-	-	1	1	1	ND (0.37) *	ND (0.00097)	ND (0.00081)	NT			
BROMOMETHANE	0.5	-	-	0.5	0.5	0.5	ND (1.9) *	ND (0.0048)	ND (0.0040)	NT			
2-BUTANONE (MEK)	4	-	-	50	50	50	ND (7.5) *	ND (0.019)	ND (0.016)	NT			
CHLORODIBROMOMETHANE	0.005	-	-	0.03	0.03	0.03	ND (0.19) *	ND (0.00097)	ND (0.00081)	NT			
CHLOROFORM	0.2	-	-	0.2	0.2	0.2	ND (0.75) *	ND (0.0019)	ND (0.0016)	NT			
1,2-DIBROMOETHANE (EDB)	0.1	-	-	0.1	0.1	0.1	ND (0.19) *	ND (0.00097)	ND (0.00081)	NT			
1,2-DICHLOROETHANE	0.1	-	-	0.1	0.1	0.1	ND (0.37) *	ND (0.00097)	ND (0.00081)	NT			
CIS-1,2-DICHLOROETHYLENE	0.1	-	-	0.1	0.1	0.1	ND (0.37) *	ND (0.00097)	ND (0.00081)	NT			
1,2-DICHLOROPROPANE	0.1	-	-	0.1	0.1	0.1	ND (0.37) *	ND (0.00097)	ND (0.00081)	NT			
2,2-DICHLOROPROPANE	0.1	-	-	-	-	-	ND (0.37) *	ND (0.00097)	ND (0.00081)	NT			
1,1-DICHLOROPROPENE	0.01	-	-	-	-	-	ND (0.75) *	ND (0.00097)	ND (0.00081)	NT			
CIS-1,3-DICHLOROPROPENE	0.01	-	-	0.4	0.4	0.4	ND (0.19) *	ND (0.00048)	ND (0.00040)	NT			
TRANS-1,3-DICHLOROPROPENE	0.01	-	-	0.4	0.4	0.4	ND (0.19) *	ND (0.00048)	ND (0.00040)	NT			
1,4-DIOXANE	0.2	-	-	6	6	6	ND (37) *	ND (0.048)	ND (0.040)	NT			
METHYL TERT-BUTYL ETHER (MTBE)	0.1	-	-	100	100	100	ND (0.37) *	ND (0.0019)	ND (0.0016)	NT			
METHYLENE CHLORIDE	0.1	-	-	20	20	20	ND (1.9) *	ND (0.0048)	ND (0.0040)	NT			
4-METHYL-2-PENTANONE (MIBK)	0.4	-	-	50	50	50	ND (3.7) *	ND (0.0097)	ND (0.0081)	NT			
NAPHTHALENE	4	-	-	20	20	20	18	ND (0.0048)	ND (0.0040)	NT			
1,1,1,2-TETRACHLOROETHANE	0.1	-	-	0.1	0.1	0.1	ND (0.37) *	ND (0.00097)	ND (0.00081)	NT			
1,1,2,2-TETRACHLOROETHANE	0.005	-	-	0.02	0.02	0.02	ND (0.19) *	ND (0.00048)	ND (0.00040)	NT			
1,1,2-TRICHLOROETHANE	0.1	-	-	2	2	2	ND (0.37) *	ND (0.00097)	ND (0.00081)	NT			
TRICHLOROETHYLENE	0.3	-	-	0.3	0.3	0.3	ND (0.37) *	ND (0.00097)	ND (0.00081)	NT			
VINYL CHLORIDE	0.7	-	-	0.7	0.7	0.7	ND (0.75) *	ND (0.0048)	ND (0.0040)	NT			
TOTAL VOCs	-	10	4	-	-	-	18	ND	ND	NT			
SVOCs by SW-846 8270D (mg/Kg)													
BENZO(G,H,I)PERYLENE	1000	-	-	1000	3000	5000	NT	NT	NT	0.94			
BIS(2-CHLOROETHYL)ETHER	0.7	-	-	0.7	0.7	0.7	NT	NT	NT	ND (1.8) *			
BIS(2-CHLOROISOPROPYL)ETHER	0.7	-	-	0.7	0.7	0.7	NT	NT	NT	ND (1.8) *			
4-CHLOROANILINE	1	-	-	100	100	100	NT	NT	NT	ND (3.5) *			
2-CHLOROPHENOL	0.7	-	-	100	100	100	NT	NT	NT	ND (1.8) *			
DIBENZ(A,H)ANTHRACENE	0.7	-	-	0.7	4	30	NT	NT	NT	ND (0.89) *			
1,4-DICHLOROBENZENE	0.7	-	-	1	1	1	NT	NT	NT	ND (1.8) *			
2,4-DICHLOROPHENOL	0.7	-	-	60	60	60	NT	NT	NT	ND (1.8) *			
2,4-DIMETHYLPHENOL	0.7	-	-	100	100	100	NT	NT	NT	ND (1.8) *			
DIMETHYLPHthalate	0.7	-	-	50	50	50	NT	NT	NT	ND (1.8) *			
2,4-DINITROPHENOL	3	-	-	50	50	50	NT	NT	NT	ND (3.5) *			
2,4-DINITROTOLUENE	0.7	-	-	2	10	50	NT	NT	NT	ND (1.8) *			
HEXACHLOROBENZENE	0.7	-	-	0.7	0.8	0.8	NT	NT	NT	ND (1.8) *			
HEXACHLOROETHANE	0.7	-	-	3	3	3	NT	NT	NT	ND (1.8) *			
2-METHYLNAPHTHALENE	0.7	-	-	80	80	80	NT	NT	NT	ND (0.89) *			
NAPHTHALENE	4	-	-	20	20	20	NT	NT	NT	0.97			
PHENANTHRENE	10	-	-	500	1000	3000	NT	NT	NT	1.1			
PHENOL	1	-	-	50	50	50	NT	NT	NT	ND (1.8) *			
PYRENE	1000	-	-	1000	3000	5000	NT	NT	NT	1.3			
2,4,6-TRICHLOROPHENOL	0.7	-	-	20	20	20	NT	NT	NT	ND (1.8) *			
TOTAL SVOCs	-	100	100	-	-	-	NT	NT	NT	4.31			
PCBs by SW-846 8082A (mg/Kg)													
Total PCBs	1	2	2	1	4	4	NT	NT	NT	ND (0.13)			
Total Petroleum Hydrocarbons by SW-846 8015C (mg/Kg)													
TPH	1000	5000	2500	1000	3000	5000	NT	NT	NT	260			

NOTES:

1. Bolded values indicate detection above laboratory reporting limit.
2. Shaded values exceed the MCP Reportable Concentrations (RCs).
3. ND = Not detected above the lab reporting limits shown in parenthesis.
4. NT = Not tested.
5. - = No Method 1 Standard or UCL available
6. An asterisk (*) following a detection limit indicates that the minimum laboratory reporting limit exceeds one or more of the regulatory criteria.

APPENDIX B

BORING LOGS

SAMPLE/SAMPLER TYPE GRAPHICS



GRAB SAMPLE
STANDARD PENETRATION SPLIT SPOON SAMPLER
 (2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)

GROUND WATER GRAPHICS

- WATER LEVEL (level where first observed)
- WATER LEVEL (level after exploration completion)
- WATER LEVEL (additional levels after exploration)
- OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, i.e., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS

WOH - Weight of Hammer
WOR - Weight of Rod

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

GRAVELS (More than half of coarse fraction is larger than the #200 sieve)	CLEAN GRAVEL WITH <5% FINES	Cu ≥ 4 and 1 ≤ Cc ≤ 3		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES	
		Cu < 4 and/or 1 > Cc > 3		GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES	
	GRAVELS WITH 5% TO 12% FINES	Cu ≥ 4 and 1 ≤ Cc ≤ 3		GW-GM	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES	
				GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES	
		Cu < 4 and/or 1 > Cc > 3		GP-GM	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES	
				GP-GC	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES	
	GRAVELS WITH > 12% FINES			GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES	
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	
				GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES	
	COARSE GRAINED SOILS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	Cu ≥ 6 and 1 ≤ Cc ≤ 3		SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			Cu < 6 and/or 1 > Cc > 3		SP	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH 5% TO 12% FINES	Cu ≥ 6 and 1 ≤ Cc ≤ 3		SW-SM	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
				SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES	
Cu < 6 and/or 1 > Cc > 3				SP-SM	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES	
				SP-SC	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES	
SANDS WITH > 12% FINES				SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES	
				SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES	
				SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES	
FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)		SILTS AND CLAYS (Liquid Limit less than 50)		ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY	
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
				CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	SILTS AND CLAYS (Liquid Limit greater than 50)		OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY		
			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT		
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
		OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY			

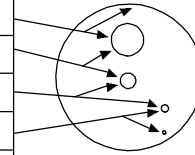


PROJECT NO.: 20170208
 DRAWN BY:
 CHECKED BY:
 DATE:
 REVISED: -

GRAPHICS KEY
 Inman Square Intersection Improvements
 Inman Square
 Cambridge, MA

GRAIN SIZE

DESCRIPTION	SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders	>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles	3 - 12 in. (76.2 - 304.8 mm.)	3 - 12 in. (76.2 - 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse 3/4 - 3 in. (19 - 76.2 mm.)	3/4 - 3 in. (19 - 76.2 mm.)	Thumb-sized to fist-sized
	fine #4 - 3/4 in. (#4 - 19 mm.)	0.19 - 0.75 in. (4.8 - 19 mm.)	Pea-sized to thumb-sized
Sand	coarse #10 - #4	0.079 - 0.19 in. (2 - 4.9 mm.)	Rock salt-sized to pea-sized
	medium #40 - #10	0.017 - 0.079 in. (0.43 - 2 mm.)	Sugar-sized to rock salt-sized
	fine #200 - #40	0.0029 - 0.017 in. (0.07 - 0.43 mm.)	Flour-sized to sugar-sized
Fines	Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller



SECONDARY CONSTITUENT

Term of Use	AMOUNT	
	Secondary Constituent is Fine Grained	Secondary Constituent is Coarse Grained
Trace	<5%	<15%
With	≥5 to <15%	≥15 to <30%
Modifier	≥15%	≥30%

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	SPT - N ₆₀ (# blows / ft)	Pocket Pen (tsf)	UNCONFINED COMPRESSIVE STRENGTH (Q _u)(psf)	VISUAL / MANUAL CRITERIA
Very Soft	<2	PP < 0.25	<500	Thumb will penetrate more than 1 inch (25 mm). Extrudes between fingers when squeezed.
Soft	2 - 4	0.25 ≤ PP <0.5	500 - 1000	Thumb will penetrate soil about 1 inch (25 mm). Remolded by light finger pressure.
Medium Stiff	4 - 8	0.5 ≤ PP <1	1000 - 2000	Thumb will penetrate soil about 1/4 inch (6 mm). Remolded by strong finger pressure.
Stiff	8 - 15	1 ≤ PP <2	2000 - 4000	Can be imprinted with considerable pressure from thumb.
Very Stiff	15 - 30	2 ≤ PP <4	4000 - 8000	Thumb will not indent soil but readily indented with thumbnail.
Hard	>30	4 ≤ PP	>8000	Thumbnail will not indent soil.

REACTION WITH HYDROCHLORIC ACID

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

FROM TERZAGHI AND PECK, 1948; LAMBE AND WHITMAN, 1969; FHWA, 2002; AND ASTM D2488

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT-N ₆₀ (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 - 15
Loose	4 - 10	5 - 12	5 - 15	15 - 35
Medium Dense	10 - 30	12 - 35	15 - 40	35 - 65
Dense	30 - 50	35 - 60	40 - 70	65 - 85
Very Dense	>50	>60	>70	85 - 100

FROM TERZAGHI AND PECK, 1948

STRUCTURE

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness.
Laminated	Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay, note thickness.

PLASTICITY

DESCRIPTION	LL	FIELD TEST
Non-plastic	NP	A 1/8-in. (3 mm.) thread cannot be rolled at any water content.
Low (L)	< 30	The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit.
Medium (M)	30 - 50	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit.
High (H)	> 50	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit.

ANGULARITY

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.



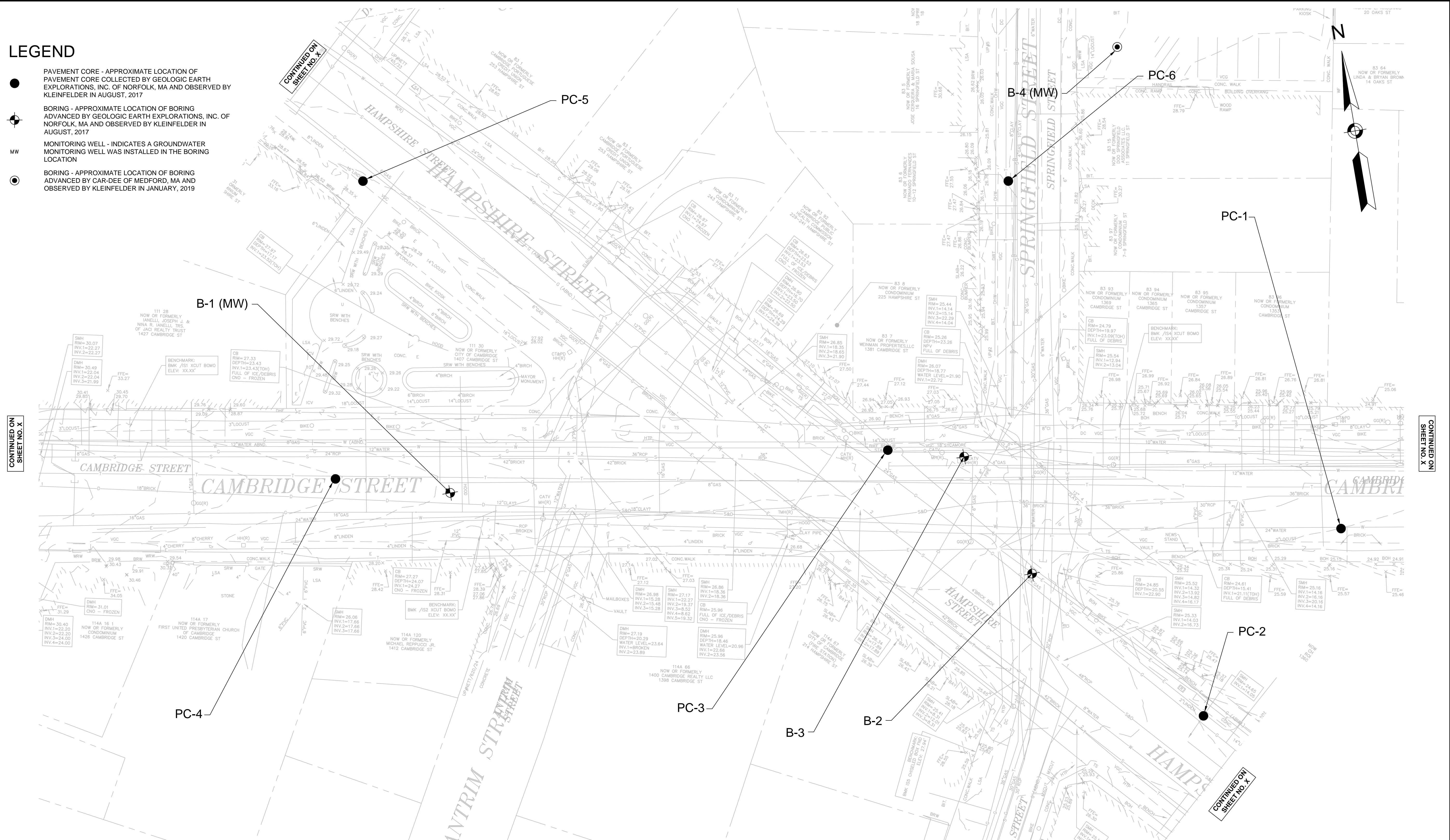
PROJECT NO.: 20170208
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

SOIL DESCRIPTION KEY

Inman Square Intersection Improvements
Inman Square
Cambridge, MA

LEGEND

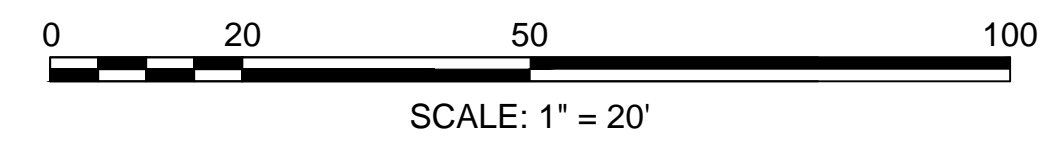
- PAVEMENT CORE - APPROXIMATE LOCATION OF PAVEMENT CORE COLLECTED BY GEOLOGIC EARTH EXPLORATIONS, INC. OF NORFOLK, MA AND OBSERVED BY KLEINFELDER IN AUGUST, 2017
- ⊕ BORING - APPROXIMATE LOCATION OF BORING ADVANCED BY GEOLOGIC EARTH EXPLORATIONS, INC. OF NORFOLK, MA AND OBSERVED BY KLEINFELDER IN AUGUST, 2017
- MW MONITORING WELL - INDICATES A GROUNDWATER MONITORING WELL WAS INSTALLED IN THE BORING LOCATION
- BORING - APPROXIMATE LOCATION OF BORING ADVANCED BY CAR-DEE OF MEDFORD, MA AND OBSERVED BY KLEINFELDER IN JANUARY, 2019



CONTINUED ON SHEET NO. X

CONTINUED ON SHEET NO. X

CAD FILE: G:\clients\Cambridge_MA\20170208.005A - Inman Square Intersection\Drawings\Civil\Working\Drawings\Boring Locations.dwg LAYOUT: 2x34Horiz (2) PLOTTED: 2/8/2019 3:24 PM BY: peter.bonaiuto



100% DESIGN
NOT FOR CONSTRUCTION

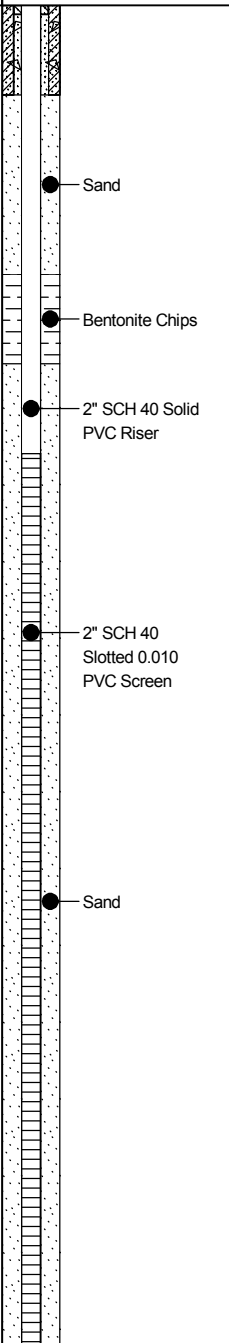
					<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>Scale</td><td>AS NOTED</td></tr> <tr><td>Date</td><td>FEBRUARY 2019</td></tr> <tr><td>Job No.</td><td>20170208.005A</td></tr> <tr><td>Designed by</td><td>JVR</td></tr> <tr><td>Drawn by</td><td>JVR</td></tr> <tr><td>Checked by</td><td>BMS</td></tr> <tr><td>Approved by</td><td>CMC</td></tr> </table>	Scale	AS NOTED	Date	FEBRUARY 2019	Job No.	20170208.005A	Designed by	JVR	Drawn by	JVR	Checked by	BMS	Approved by	CMC		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>Client</td><td>CITY OF CAMBRIDGE, MASSACHUSETTS</td></tr> <tr><td>Project</td><td>INMAN SQUARE INTERSECTION SAFETY IMPROVEMENT PROJECT</td></tr> <tr><td>Drawing</td><td>FIGURE 1 - BORING AND PAVEMENT CORE LOCATION PLAN</td></tr> </table>	Client	CITY OF CAMBRIDGE, MASSACHUSETTS	Project	INMAN SQUARE INTERSECTION SAFETY IMPROVEMENT PROJECT	Drawing	FIGURE 1 - BORING AND PAVEMENT CORE LOCATION PLAN	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>Sheet</td><td></td></tr> <tr><td>File No.</td><td>XXXX</td></tr> </table>	Sheet		File No.	XXXX
Scale	AS NOTED																															
Date	FEBRUARY 2019																															
Job No.	20170208.005A																															
Designed by	JVR																															
Drawn by	JVR																															
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Approved by	CMC																															
Client	CITY OF CAMBRIDGE, MASSACHUSETTS																															
Project	INMAN SQUARE INTERSECTION SAFETY IMPROVEMENT PROJECT																															
Drawing	FIGURE 1 - BORING AND PAVEMENT CORE LOCATION PLAN																															
Sheet																																
File No.	XXXX																															

PLOTTED: 10/19/2017 10:26 AM BY: SBridges

BORING LOG B-1

Date Begin - End: 8/08/2017 - 8/10/2017 **Drilling Company:** Geologic
Logged By: N. Biller **Drill Crew:** D. Jacobs
Hor.-Vert. Datum: Not Available **Drilling Equipment:** CME track mounted **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Drive and Wash
Weather: 80s, clear **Boring Diameter:** 4" in. I.D.

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS							MONITORING WELL CONSTRUCTION*				
		Surface Condition: Bituminous pavement	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit		Plasticity Index (NP=NonPlastic)			
Lithologic Description																	
0-7	7 Inches Bituminous Pavement	G1															
7-4	4 Inch granite cobblestone paver	G2															
4-5	G1: Fill Clayey SAND with Gravel (SC): fine to coarse-grained, dark gray, odor, moist, some, silt, cobblestone fragments. PID = 4.8 ppm. G2: CLAY with Sand and Gravel (CL): dark gray, moist, some silt, contains brick fragments. PID = 1.8 ppm. G3: Fill Sandy SILT with Gravel (ML): low plasticity, olive gray, odor, moist, fine to coarse sand, trace gravel. Contains cobblestone ,brick, and wood fragments. PID = 1.5 ppm G4: Similar to G3. PID = 0.6ppm. G5: PID=0.3 Fill Sandy Lean CLAY with Gravel (CL): low plasticity, olive gray, moist, fine to coarse sand, trace gravel, contains brick and cobble fragments. PID = 0.3 ppm. G6: Similar to G5, PID = 1.9 ppm.	G3															
		G4															
		G5															
		G6															
5-7	S7: Fill Sandy Lean CLAY with Gravel (CL): low plasticity, brown to reddish brown, moist, stiff, fine to coarse sand, angular gravel, contains brick fragments.	S7	BC=7 8 5 8		13"												
7-10	S8: Fill Sandy Lean CLAY with Gravel (CL): low plasticity, light gray, moist, stiff, fine to coarse sand, trace angular gravel, brick and bituminous pavement framents.	S8	BC=7 10 13 16		17"												
10-12	S9: Fill Lean CLAY (CL): low plasticity, gray to light brown, moist, stiff	S9	BC=9 8 10 18		5"												
12-14	S10A: (top 4 inches) Similar to S9 except with cobble fragments, and stiff.	S10	BC=8 12 12 13		24"												
14-16	S10B: (bottom 20 inches) Lean CLAY (CL): medium plasticity, gray, wet, stiff																



PROJECT NUMBER: 20170208.005A OFFICE FILTER: CAMBRIDGE
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2017.GLB [KLF_BORING/TEST PIT SOIL LOG]



PROJECT NO.: 20170208
 DRAWN BY: SJB
 CHECKED BY: CM
 DATE:
 REVISED: 10/17/2017

BORING LOG B-1
 Inman Square Intersection Improvements
 Inman Square
 Cambridge, MA

PLATE
B-1
 PAGE: 1 of 2


PLOTTED: 10/19/2017 10:26 AM BY: SBridges

Date Begin - End: 8/08/2017 - 8/10/2017 **Drilling Company:** Geologic
Logged By: N. Biller **Drill Crew:** D. Jacobs
Hor.-Vert. Datum: Not Available **Drilling Equipment:** CME track mounted **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Drive and Wash
Weather: 80s, clear **Boring Diameter:** 4" in. I.D.

BORING LOG B-1

Depth (feet)	Graphical Log	FIELD EXPLORATION					LABORATORY RESULTS						MONITORING WELL CONSTRUCTION*	
		Surface Condition: Bituminous pavement	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit		Plasticity Index (NP=NonPlastic)
Lithologic Description														
		S10B: (bottom 20 inches) Lean CLAY (CL) : medium plasticity, gray, wet, stiff												
20		S11: Similar to S10B except trace angular gravel.	S11		BC=3 7 8 9	24"								
25		The boring was terminated at approximately 21 ft. below ground surface. Monitoring Well installed to a depth of 21ft.					GROUNDWATER LEVEL INFORMATION: ▼ Groundwater was observed at approximately 7.5 ft. below ground surface 11 days after drilling completion. GENERAL NOTES: A PID (ppmv) was used for environmental field screening.							

PROJECT NUMBER: 20170208.005A OFFICE FILTER: CAMBRIDGE
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2017.GLB [_KLF_BORING/TEST PIT SOIL LOG]

	PROJECT NO.: 20170208	BORING LOG B-1 Inman Square Intersection Improvements Inman Square Cambridge, MA	PLATE
	DRAWN BY: SJB CHECKED BY: CM DATE: REVISED: 10/17/2017		B-1
			PAGE: 2 of 2

Date Begin - End: 8/08/2017 - 8/09/2017 **Drilling Company:** Geologic
Logged By: N. Biller/ S. Bridges **Drill Crew:** D. Jacobs
Hor.-Vert. Datum: Not Available **Drilling Equipment:** CME track mounted **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Drive and Wash
Weather: 80s, clear **Boring Diameter:** 4" in. I.D.

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS								
		Surface Condition: Bituminous pavement	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
Lithologic Description														
	7 Inches Bituminous Pavement	G1												
	G1: Fill Poorly-graded GRAVEL with Silt and Sand (GP-GM): dark gray, moist, fine to coarse sand, subangular gravel, trace silt. PID = 0.3 ppm.	G2												
	G2: Similar to G1. PID = 0.6 ppm.	G3												
	G3: Similar to G1 except with brick fragments. PID = 0.3 ppm.	G4												
	G4: Fill Poorly-graded SAND with Gravel (SP): olive gray, moist, trace silt. PID = 0.4 ppm.	G5												
	G5: Similar to G4 except with bituminous pavement fragments. PID = 0.6 ppm.	G6												
	G6: Similar to G4 except with bituminous pavement fragments. PID = 0.2 ppm.	S7			BC=10 11 14 13	12"								
	S7: Fill Silty SAND with Gravel (SM): fine to coarse-grained, low plasticity, olive brown, moist, medium dense, angular to subrounded gravel, PID = 0.1 ppm.	S8			BC=11 7 4 7	15"								
	S8A: (top 5 inches) Fill Poorly-graded SAND with Silt and Gravel (SP-SM): fine to coarse-grained, non-plastic, olive brown and gray, moist, medium dense, angular to subrounded gravel. PID = 0.1 ppm.													
	S8B: (bottom 10 inches) SILT (ML): light brownish gray, moist, medium stiff, orange staining, some pockets of lean clay.													
	Assumed lithology change													
	S9: Lean CLAY (CL): medium plasticity, light gray, moist, medium stiff	S9			BC=2 2 2 3	24"								



PROJECT NO.: 20170208
 DRAWN BY: SJB
 CHECKED BY: CM
 DATE:
 REVISED: 10/17/2017

BORING LOG B-2
 Inman Square Intersection Improvements
 Inman Square
 Cambridge, MA


PLATE
 B-2
 PAGE: 1 of 2

PLOTTED: 10/19/2017 10:26 AM BY: SBridges

Date Begin - End: 8/08/2017 - 8/09/2017	Drilling Company: Geologic	BORING LOG B-2	
Logged By: N. Biller/ S. Bridges	Drill Crew: D. Jacobs		
Hor.-Vert. Datum: Not Available	Drilling Equipment: CME track mounted		Hammer Type - Drop: 140 lb. Auto - 30 in.
Plunge: -90 degrees	Drilling Method: Drive and Wash		
Weather: 80s, clear	Boring Diameter: 4" in. I.D.		

Depth (feet)	Graphical Log	FIELD EXPLORATION					LABORATORY RESULTS							
		Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Surface Condition: Bituminous pavement												
		Assumed lithologic change	S9 (cont.)			24" (cont.)								
20		S10: Similar to S9 except wet.	S10		BC=1 3 3 4	5"								
25		The boring was terminated at approximately 21 ft. below ground surface. The boring was backfilled with cuttings and patched at surface on August 09, 2017.					GROUNDWATER LEVEL INFORMATION: Groundwater was not observed during drilling or after completion. GENERAL NOTES:							

PROJECT NUMBER: 20170208.005A
 OFFICE FILTER: CAMBRIDGE
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2017.GLB [_KLF_BORING/TEST PIT SOIL LOG]


 Bright People. Right Solutions.	PROJECT NO.: 20170208	BORING LOG B-2	PLATE
	DRAWN BY: SJB		
CHECKED BY: CM			B-2
DATE:			
REVISED: 10/17/2017			PAGE: 2 of 2

PLOTTED: 10/19/2017 10:26 AM BY: SBridges

Date Begin - End: <u>8/08/2017 - 8/09/2017</u>	Drilling Company: <u>Geologic</u>	BORING LOG B-3
Logged By: <u>N. Biller/ S. Bridges</u>	Drill Crew: <u>D. Jacobs</u>	
Hor.-Vert. Datum: <u>Not Available</u>	Drilling Equipment: <u>CME track mounted</u>	Hammer Type - Drop: <u>140 lb. Auto - 30 in.</u>
Plunge: <u>-90 degrees</u>	Drilling Method: <u>Drive and Wash</u>	
Weather: <u>80s, clear</u>	Boring Diameter: <u>4" in. I.D.</u>	

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS							Additional Tests/Remarks	
		Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit		Plasticity Index (NP=NonPlastic)
	Surface Condition: Bituminous pavement													
	Lithologic Description													
	1 inches bituminous pavement	G1												
	G1: Fill Poorly-graded GRAVEL with Silt and Sand (GP-GM): fine to coarse-grained, olive brown, moist, subangular gravel. PID = 0.1 ppm.	G2												
	G2: Fill Sandy SILT with Gravel (ML): low plasticity, olive gray, moist, fine to coarse sand, subrounded gravel. PID = 0.4 ppm.	G3												
	G3: Fill Sandy SILT with Gravel (ML): fine to medium-grained, low plasticity, olive brown, moist, PID = 0.2 ppm.	G4												
	G4: Fill Sandy SILT (ML): olive gray, moist, fine to coarse sand, trace gravel. PID = 0.4 ppm.	G5												
	G5: Fill Clayey SAND with Gravel (SC): fine to medium-grained, olive gray, moist, angular to rounded gravel, pieces of brick, glass, bituminous pavement. PID = 0.0 ppm.	G6												
	G6: Similar to G5. PID = 0.0 ppm.	S7			BC=7 12 10 14	23"								
	S7: Fill Sandy SILT (ML): low plasticity, gray, moist, stiff, fine to medium sand, trace angular gravel, bituminous pavement fragments. PID = 0.0 ppm.	S8			BC=15 14 15 17	12"								
	S8: Similar to S7	S9			BC=25 8 8 9	NR								
	S9: No recovery. Cobble in sampler tip.	S10			BC=12 10 8 10	16"								
	S10: similar to S7.	S11			BC=3 4 10 7	24"								
	S11: SILT (ML): low plasticity, olive brown, moist, stiff, trace angular gravel.													


PROJECT NUMBER: 20170208.005A OFFICE FILTER: CAMBRIDGE
GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2017.GLB [KLF_BORING/TEST PIT SOIL LOG]

 <p>KLEINFELDER Bright People. Right Solutions.</p>	PROJECT NO.: 20170208	BORING LOG B-3	PLATE
	DRAWN BY: SJB	Inman Square Intersection Improvements Inman Square Cambridge, MA	B-3
CHECKED BY: CM	DATE:		
REvised: 10/17/2017			PAGE: 1 of 2

Date Begin - End: 8/08/2017 - 8/09/2017 **Drilling Company:** Geologic
Logged By: N. Biller/ S. Bridges **Drill Crew:** D. Jacobs
Hor.-Vert. Datum: Not Available **Drilling Equipment:** CME track mounted **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Drive and Wash
Weather: 80s, clear **Boring Diameter:** 4" in. I.D.

BORING LOG B-3

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS								
		Surface Condition: Bituminous pavement	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
Lithologic Description														
		S11: SILT (ML): low plasticity, olive brown, moist, stiff, trace angular gravel.	S11 (cont.)			24" (cont.)								
		Assumed lithology change												
20		S12: Lean CLAY (CL): low plasticity, gray, wet, soft to stiff	S12		BC=2 5 4 5	13"								
25		The boring was terminated at approximately 21 ft. below ground surface. The boring was backfilled with cuttings and patched at surface on August 09, 2017.				GROUNDWATER LEVEL INFORMATION: Groundwater was not observed during drilling or after completion. GENERAL NOTES:								

	PROJECT NO.: 20170208	BORING LOG B-3 Inman Square Intersection Improvements Inman Square Cambridge, MA	PLATE
	DRAWN BY: SJB		B-3
CHECKED BY: CM	DATE:		
REVISED: 10/17/2017			PAGE: 2 of 2

PLOTTED: 01/31/2019 03:12 PM BY: CoMiller

BORING LOG B-4/ MW

Date Begin - End: 1/04/2019 **Drilling Company:** Carr-Dee
Logged By: T. Bernier **Drill Crew:** Frank
Hor.-Vert. Datum: Not Available **Drilling Equipment:** Truck Mounted Rig **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger
Weather: Clear, 45° F **Exploration Diameter:** 3.75 in. I.D.

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS							MONITORING WELL CONSTRUCTION*	
		Surface Condition: Asphalt	Sample Number	Sample Type	Blow Counts (pcf) = Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit		Plasticity Index (NP=NonPlastic)
		Lithologic Description												
		ASPHALT: 6"												Concrete
		S1: FILL: Silty SAND with Gravel (SM): fine to coarse-grained sand and gravel, subangular to subrounded, brown, dry, medium dense, asphalt debris	S1		BC=20 12 4	2"								2" SCH 40 Solid PVC Riser Auger Cuttings
		S2: Silty SAND (SM): fine to medium-grained sand, fine-grained gravel, subangular to subrounded, olive gray, moist, loose to medium dense	S2		BC=4 5 6 10	20"								
		S3: similar to S2 except with more fines, less sand, medium dense	S3		BC=4 9 13 14	17"								
		S4A: similar to S2 except with more fines, less sand, medium dense	S4A		BC=11 16 15 15	20"								
		S4B: Sandy Lean CLAY with Gravel (CL): fine to coarse-grained sand, fine-grained gravel, subangular to subrounded, moist, firm	S4B		BC=9 22 24 33	20"								Bentonite Chips
		S5A: Lean CLAY with Sand (CL): fine to coarse-grained sand and gravel, subrounded to rounded, brownish gray, wet, firm to hard	S5A											
		S5B: Silty SAND (SM): fine to coarse-grained sand and gravel, gray, wet, dense	S5B											
		S6: Sandy Lean CLAY with Gravel (CL): fine to coarse-grained sand and gravel, subangular to rounded, brownish gray, moist to wet, firm to hard	S6		BC=21 16 24 20	15"								
		S7: Clayey GRAVEL with Sand (GC): fine to coarse-grained sand and gravel, angular to subangular, wet, very dense	S7		BC=19 41 34 29	10"								2" SCH 40 Slotted 0.010 PVC Screen
		S8: Lean CLAY (CL): fine-grained sand, medium plasticity, grayish blue, wet, firm	S8		BC=8 8 13 13	18"								20/40 Sand Pack
		S9: similar to S8	S9		BC=7 5 5 6	8"								
		S10: similar to S8	S10		BC=4 9 7 7	24"								

The boring was terminated at approximately 20 ft. below ground surface. The boring was backfilled with auger cuttings and patched at surface on January 04, 2019.

GROUNDWATER LEVEL INFORMATION:
 ∇ Groundwater was observed at approximately 8 ft. below ground surface during drilling.
 ▼ Groundwater was observed at approximately 5 ft. below ground surface at the end of drilling.
GENERAL NOTES:

PROJECT NUMBER: 20170208.005 OFFICE FILTER: BOSTON PROJECT NUMBER: 20170208.005
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2017.GLB KLF_BORING/TEST PIT/ SOIL LOG



PROJECT NO.: 20170208
 DRAWN BY: MAP
 CHECKED BY: DD
 DATE:
 REVISED: -

BORING LOG B-4/ MW
 Inman Square Intersection Improvements
 Springfield Street Lot
 Cambridge, MA

APPENDIX C

CITY OF CAMBRIDGE SIGN DETAILS



S1-1



W16-9p

OR



W16-2

OR



W16-2a

OR



OR



S1-1



W16-7

W16-7pl

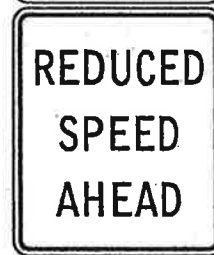
School Crosswalk
Warning Assembly



S3-1



S4-3



S2-5a

School Reduced
Speed Ahead
Assembly

SCHOOL SPEED ZONE
SIGNAGE

BLACK ON
YELLOW



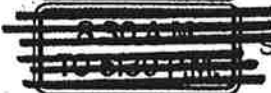
S4-3

24" x 30"
BLACK ON
WHITE



R2-1

OR



S4-1

OR

BLACK ON
YELLOW



S4-2

OR

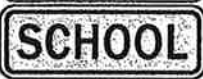


S4-4

School Speed Limit
Assembly



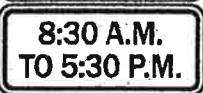
R2-6P



S4-3



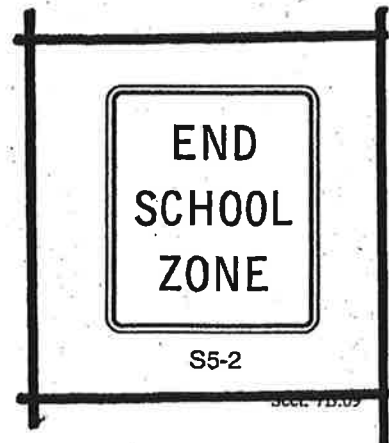
R2-1



S4-1



S5-1



S5-2

12"

RESERVED
PARKING

2"

2"

(SERIES B LETTERING)

18"



WHITE ON
BLUE BACKGROUND

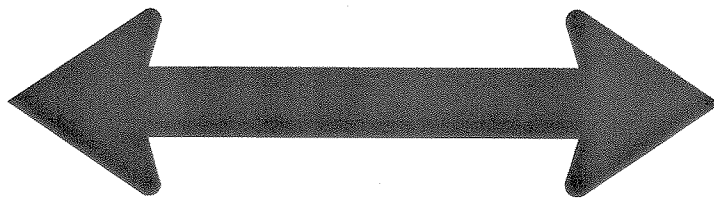
6"

CT-800

VIOLATORS WILL BE
FINED AND TOWED

1"

1"

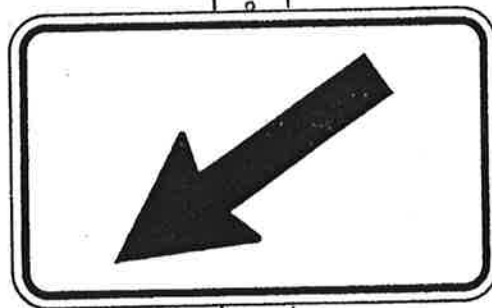


GREEN
LETTERING
BORDER & ARROW
ON WHITE
BACKGROUND

CT 800



W11A-2



~~W16-7P~~
W16-7PL



~~24~~
24"

MUTCD - PEDESTRIAN WARNING SIGN.

CT600

TOW ZONE

NO PARKING

STREET CLEANING

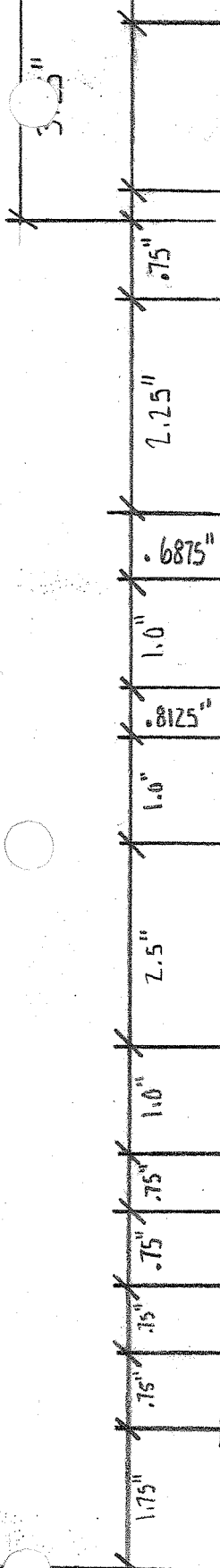
8AM TO 2PM

(THIS SPACE FOR DAY OF WEEK)
← LEAVE BLANK →

EACH MONTH

APRIL 1ST TO DEC. 31ST

EXCEPT HOLIDAYS



WHITE LETTERING
AND RED BACKGROUND

18"

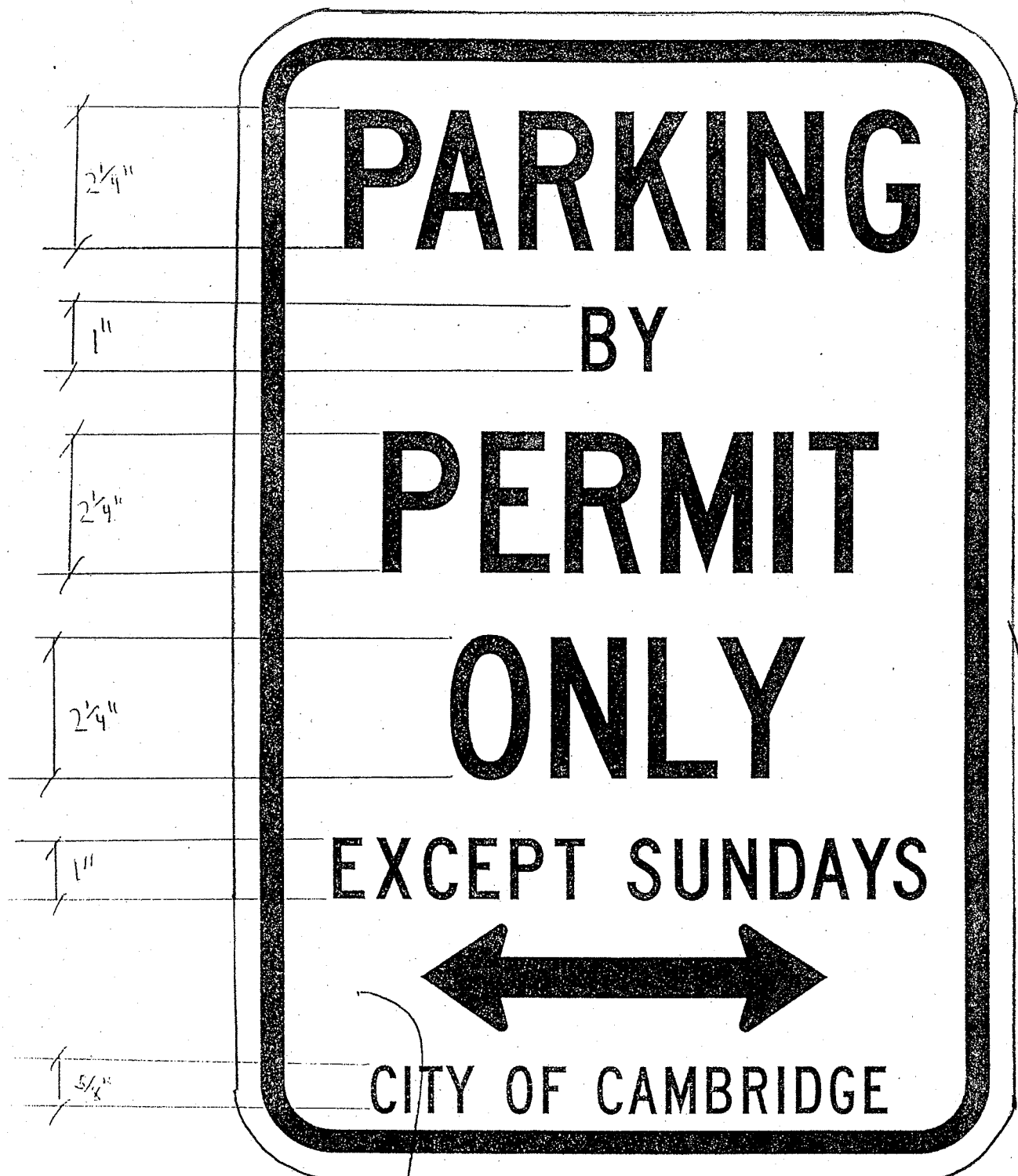
2 COLORS
WHIT & RED

RED LETTERING
AND BORDER ON
WHITE BACKGROUND

12"

(SERIES B TEXT)

CT-390



BLACK LETTERING & ARROW & BORDER
ON WHITE BACK GROUND.

TOW ZONE

NO PARKING

STREET CLEANING

8AM TO 2PM

DAY OF WEEK

EACH MONTH

APRIL 1ST TO DEC. 31ST

EXCEPT HOLIDAYS

PARKING

BY

PERMIT

ONLY

EXCEPT SUNDAYS



CITY OF CAMBRIDGE

18"

24"

4 COLORS-ENGINEER GRADE
USE SAME SPELS FROM SIGNS CT-390 & CT-200

1 1/2" WHITE LETTERING (SERIES B)

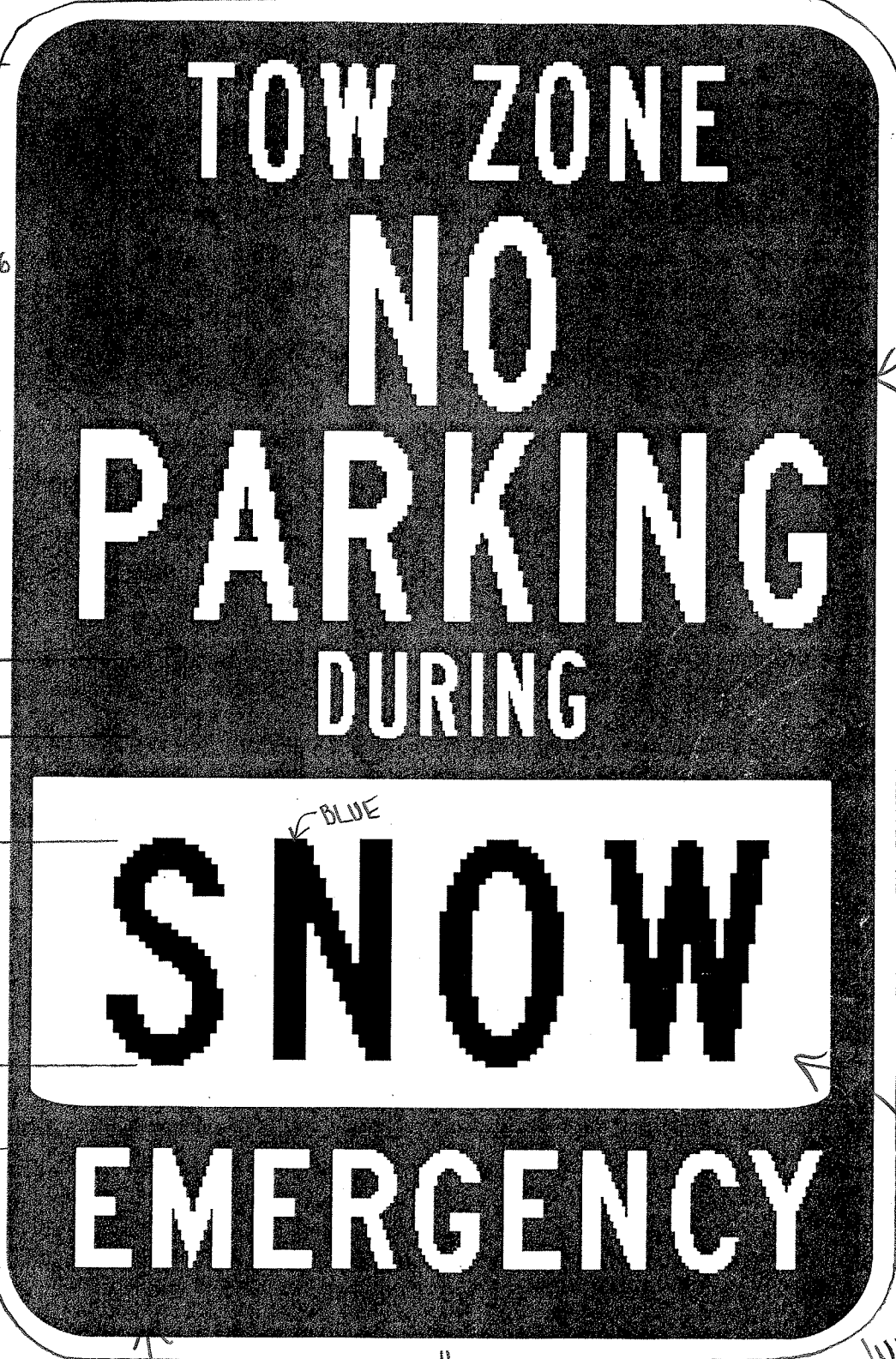
2 1/4" WHITE LETTERING (SERIES C)

2 1/4" WHITE LETTERING (SERIES C)

1" WHITE LETTERING (SERIES B)

2 1/2" BLUE LETTERING (SERIES C)

1 1/2" WHITE LETTERING (SERIES B)



RED

18"

BLUE

WHITE

RED

12"

* WHITE BORDER *

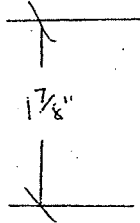
3 COLORS
BLUE, RED, WHITE

SNOW

CT199

TOW ZONE

WHITE LETTERING ON
RED BACKGROUND

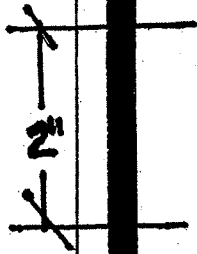


NO

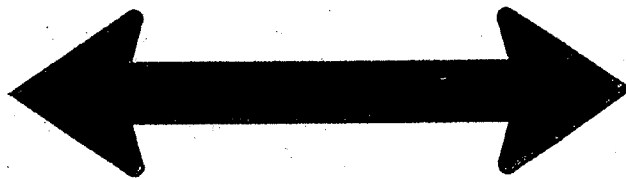
11 8/16"

STOPPING

1 7/8"



ANYTIME



12"

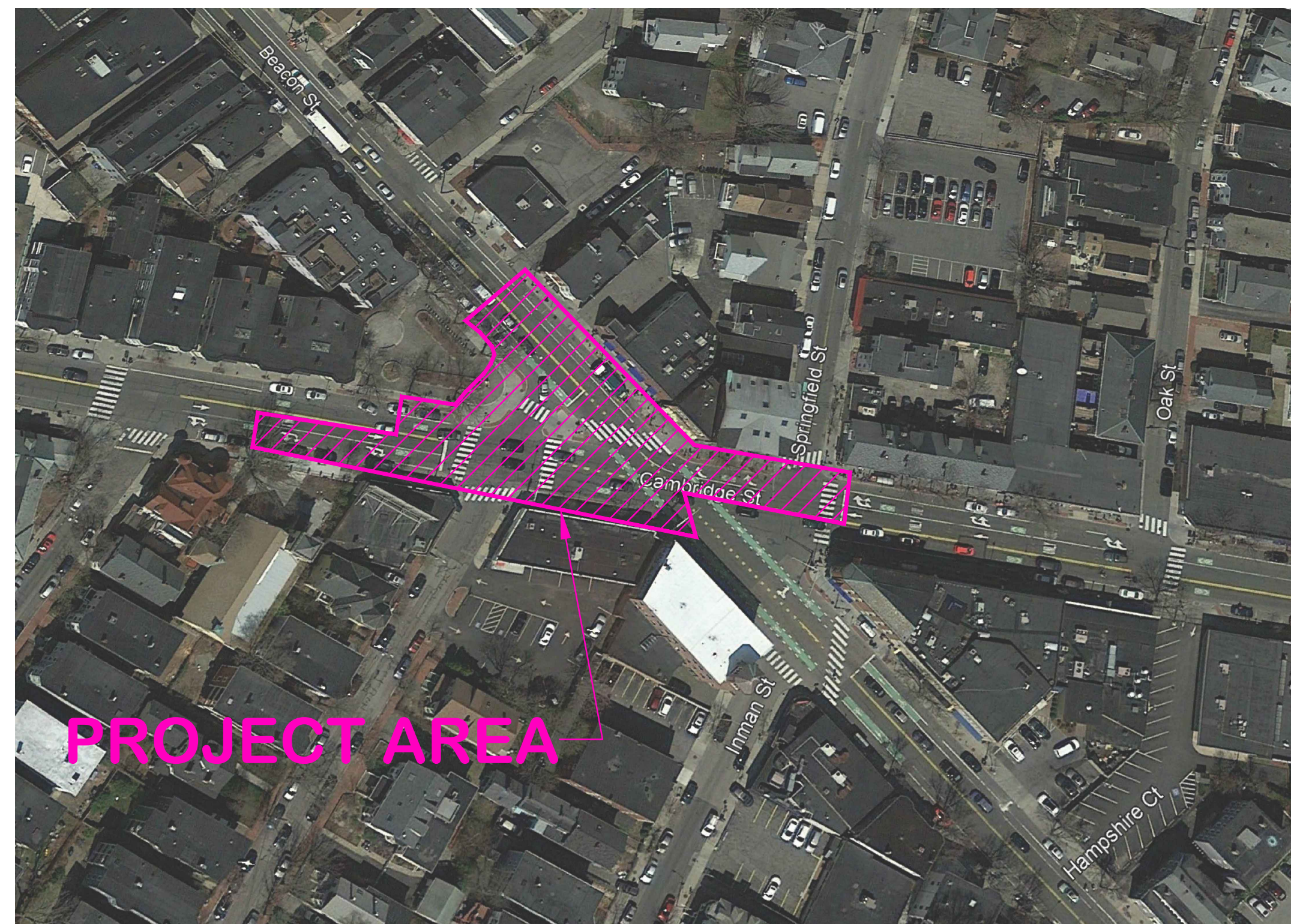
RED LETTERING ON WHITE BACKGROUND

APPENDIX D

Subsurface Utility Investigation Plans

INMAN SQUARE SAFETY IMPROVEMENTS PROJECT CAMBRIDGE

PREPARED FOR
KLEINFELDER
215 FIRST STREET, SUITE 320
CAMBRIDGE, MA 02142

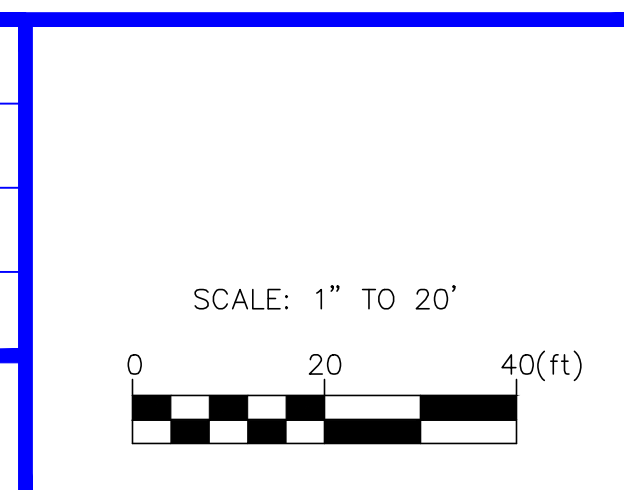


LOCUS PLAN
NOT TO SCALE

BSI ENGINEERING, INC.
100 HALLET ST, BOSTON, MA 02124
617 265 4200
December 1, 2017

INDEX OF SHEETS	SHEET NO.
COVER - C1	1
LEGEND & NOTES - L1	2
SUEPLAN	3

REV. NO.	DATE	DESCRIPTION	MADE BY	CHK. BY	APPD. BY



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BSI Engineering, Inc.
100 Hallet Street, Boston, MA 02124
Telephone (617) 265 4547 Fax (617) 209 1297 www.bsieng.com

OWNER: CITY OF CAMBRIDGE		
BSIES PLAN NO.: 17-3432	FILE: 17-3432UT02.DWG	
SUE BY: DOC/PM/SN/SBG	DRAWN BY: DOC	CHKD.: BLC
APPROVED: JFN	DATE: 12/01/2017	SCALE: 1"=20'

SUBSURFACE UTILITY ENGINEERING
INMAN SQUARE SAFETY
IMPROVEMENTS PROJECT
CAMBRIDGE

PREPARED FOR
KLEINFELDER
215 FIRST STREET, SUITE 320
CAMBRIDGE, MA 02142

CONTRACT NO.:	SHEET NO.: 1 OF 3
---------------	-------------------

BSIE LEGEND

QUALITY LEVEL "A" INFORMATION

TR-1 VACUUM EXCAVATION DATA POINT QL-A

QUALITY LEVEL "B" INFORMATION

- CS QL-B COMBINED SEWER QL-B
- CTV QL-B CABLE TELEVISION QL-B
- SD QL-B DRAIN QL-B
- F QL-B ELECTRICAL QL-B
- FA QL-B FIRE ALARM QL-B
- G QL-B GAS QL-B
- S QL-B SEWER QL-B
- ST QL-B STEAM QL-B
- T QL-B TELECOMMUNICATIONS QL-B
- TR QL-B TRAFFIC QL-B
- UAIR QL-B UNDERGROUND AIR PRODUCTS QL-B: CO2, NO2, ETC.
- U QL-B UNKNOWN TRACE SIGNAL QL-B
- W QL-B WATER QL-B

QUALITY LEVEL "C" INFORMATION

- CS QL-C COMBINED SEWER QL-C
 - CTV QL-C CABLE TELEVISION QL-C
 - SD QL-C DRAIN QL-C
 - F QL-C ELECTRICAL QL-C
 - FA QL-C FIRE ALARM QL-C
 - G QL-C GAS QL-C
 - S QL-C SEWER QL-C
 - ST QL-C STEAM QL-C
 - T QL-C TELECOMMUNICATIONS QL-C
 - TR QL-C TRAFFIC QL-C
 - UAIR QL-C UNDERGROUND AIR PRODUCTS QL-C: CO2, NO2, ETC.
 - U QL-C UNKNOWN TRACE SIGNAL QL-C
 - W QL-C WATER QL-C
- DE-T-TVD OVERHEAD ELECTRIC - TELEPHONE - CABLE
 - DE-TD OVERHEAD ELECTRIC - TELEPHONE
 - DE-TV OVERHEAD ELECTRIC - CABLE
 - DE-O OVERHEAD ELECTRIC
 - DE-TVD OVERHEAD TELEPHONE - CABLE
 - DE-O OVERHEAD TELEPHONE
 - DE-TV OVERHEAD CABLE

QUALITY LEVEL "D" INFORMATION

- CS QL-D COMBINED SEWER QL-D
- CTV QL-D CABLE TELEVISION QL-D
- SD QL-D DRAIN QL-D
- F QL-D ELECTRICAL QL-D
- FA QL-D FIRE ALARM QL-D
- G QL-D GAS QL-D
- S QL-D SEWER QL-D
- ST QL-D STEAM QL-D
- T QL-D TELECOMMUNICATIONS QL-D
- TR QL-D TRAFFIC QL-D
- UAIR QL-D UNDERGROUND AIR PRODUCTS QL-D: CO2, NO2, ETC.
- W QL-D WATER QL-D

LAND BASE

- EXISTING BUILDINGS & RELATED STRUCTURES
- BRIDGE ABUTMENTS
- MAJOR CONTOUR
- MINOR CONTOUR
- MISC. DETAILS / EDGE OF PAVEMENT
- CHAINLINK OR WOOD FENCE
- STEEL GUARD RAIL OR WROUGHT IRON FENCE
- PROPERTY LINE
- TOP OF CURBS / BACK OF SIDEWALKS
- RETAINING / STONE WALLS

SUE PLAN NOMENCLATURE

- OR \rightarrow EOI END OF INFORMATION
- (R) RECORD INFORMATION
- QL-X | QL-X CHANGE IN QUALITY LEVEL
- SUE PROJECT LIMITS
- IP IRON PIPE
- CI CAST IRON
- SFM SEWER FORCE MAIN
- FO FIBER OPTIC
- PVC POLYVINYL CHLORIDE
- SW SALT WATER
- HW HOT WATER
- CND CONDENSATE
- MH MANHOLE
- T TELEPHONE
- E ELECTRIC
- W WATER
- S SEWER
- ST STEAM
- U UNKNOWN
- UAIR UNDERGROND AIR
- (ABAND.) ABANDONED
- CH CHIMNEY
- SUMP BOTTOM OF MH STRUCTURE
- NOTE CALLOUT

WATER FACILITIES

- AC AIR COCK
- BV BUTTERFLY VALVE
- WC WATER CHECK VALVE
- HD FIRE HYDRANT
- LD LOWRY HYDRANT
- MP WATER METER PIT
- PI WATER PITOMETER
- PIV WATER POST INDICATOR VALVE
- SP WATER STAND PIPE
- SG WATER DIVISION GATE
- WG WATER GATE
- WGF WATER GATE FIRE PIPE
- WGS WATER GATE SERVICE PIPE
- WSA WATER SACRIFICIAL ANODE
- WTB WATER TEST BOX
- WV WATER VENT
- WMH WATER MANHOLE
- WVC BUTTERFLY VALVE CHAMBER

Subsurface Utility Engineering Notes:

- This plan was prepared in conformance with the American Society of Civil Engineers standard CI/ASCE 38-02 "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data".
 - BSIE will only warrant the existence or nonexistence of utility lines based on quality level A information. QL "A" information is only valid within the visible limits of the test hole.
 - BSIE will advance a vacuum test hole until a condition of practical refusal for vacuum excavation is reached. Practical refusal is defined as any of the following conditions occurring: Encountering a utility, bedrock, water table, rocks/cobbles, condition of hole instability or reaching a depth of 8'.
 - Below ground structures, unless dimensioned, are symbolic only.
 - Prior to excavation utility owners shall review and approve this drawing.
 - This drawing is prepared in color. Reproduction may alter the information contained hear in. BSIE does not warrant the information contained hear in following reproduction.
 - Use or reuse of this drawing by parties not directly contracted with BSIE is prohibited without prior written permission.
 - Base mapping/survey control is shown for information purposes only and is not warranted by BSIE.
 - BSIE recommends that all existing utilities near proposed construction activities be located by vacuum excavation (quality level A) prior to any excavation (if not already located by vacuum excavation).
- Utility Quality Level Information Index (see ASCE/CI 38-02):**
- QUALITY LEVEL D: "QL D". Utility information plotted on the drawing based solely on record information, individual recollections or the existence of utility service. It shall be noted that all information shown (other than at test hole locations, see QL A below), including but not limited to a utilities size, capacity, material composition, condition or service status shall be considered QL D even though the utility may be plotted and labeled as QL C or QL B.

QUALITY LEVEL C: "QL C". Utility information obtained and categorized as QL D, plotted to correlate with surface utility features which have been field verified, survey located and accurately transposed onto the design/construction documents. Included in this category aerial utility information and utility depiction's, which in the professional opinion of the subsurface utility engineer, represent the most probable approximate horizontal location, type and/or existence of a utility.

QUALITY LEVEL B: "QL B". Utility information derived by establishing the approximate surface horizontal location of a utility using electronic methods. Said information is subsequently field survey located and accurately reduced onto the design/construction documents.

QUALITY LEVEL A: "QL A". Utility information which has been visually verified, survey located (both horizontally and vertically) and accurately reduced onto the design/construction documents. This is typically shown as test hole or other dimensioned information.

SUE General Notes:

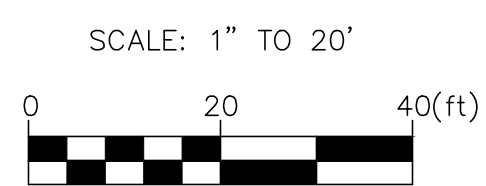
- Certain utilities shown have been traced on the ground using electronic designation techniques. Designation, or electronic utility location, is defined as the surface location of a utility line based on electronic geophysical prospecting techniques and is approximate in relation to the actual location of the possible utility.
- Certain utilities shown have been taken from available record information. These utilities may not have been verified. (See Note #4 below.)
- All existing designated utilities near proposed construction should be exactly located using Non-Destructive Air-Vacuum Excavation, if not already located by Air-Vacuum Excavation (See Quality Level A above).
- Unless Non-Destructive Air-Vacuum Excavation is utilized at a particular location, BSIE does not guarantee the existence or non-existence of utility lines
- At locations, where BSIE is directed to perform Non-Destructive Air-Vacuum Excavation, the test hole is advanced until a condition of practical refusal for Air-Vacuum Excavation is reached or hole is advanced to a depth of 8.0' (eight feet). Practical refusal being defined as encountering a utility, bedrock, water table, large rocks/ cobbles, suspected hazardous materials or a condition of hole instability.
- Where BSIE is directed to perform Non-Destructive Air-Vacuum Excavation to confirm the non-existence of utilities, BSIE will only report non-existence of utilities within the visible limits of the excavation. BSIE is not responsible for ensuring that work by others is performed at the same location as the Air-Vacuum Excavation Hole.
- Below ground structures unless otherwise depicted are symbolic only.
- Prior to any excavating, BSIE recommends that all utility owners should review this drawing for accuracy and completeness.

General Project Notes:

- Mapping provided by:
Kleinfelder
215 First Street
Suite 320
Cambridge, Ma 02142
- Horizontal and vertical survey control provided by:
Kleinfelder
215 First Street
Suite 320
Cambridge, Ma 02142

BSIE SYMBOLS LEGEND (QL-C) INFORMATION

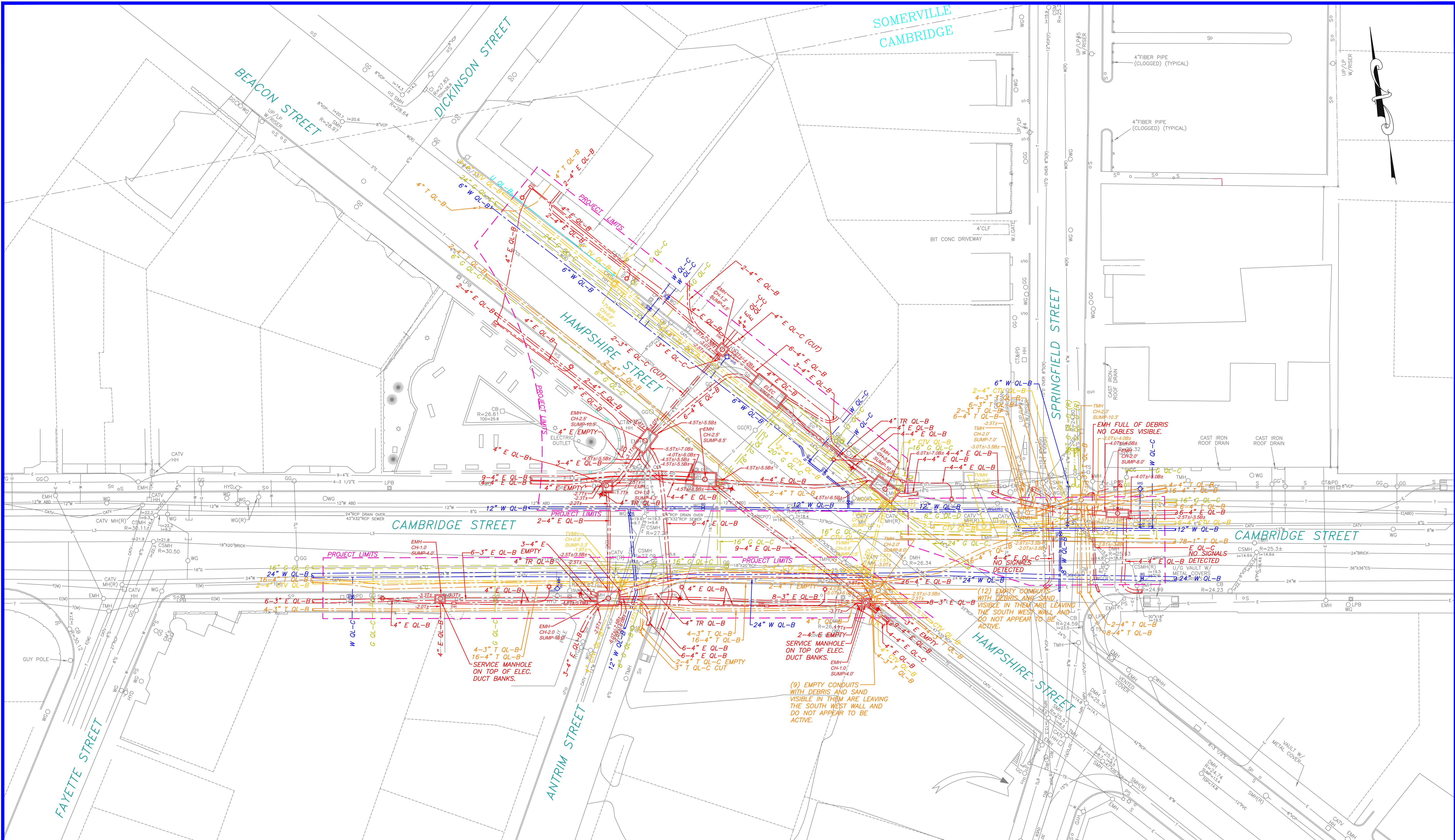
- | | | |
|------------------------------|------------------------------|---|
| CABLE TV FACILITIES | GAS FACILITIES | STEAM FACILITIES |
| CH CABLE HAND HOLE | GM GAS DIVISION GATE | SR STEAM REGULATOR PIT |
| CM CABLE MANHOLE | GC GAS GATE CIRCULAR | SM STEAM MANHOLE |
| CP CABLE PEDESTAL | GS GAS GATE SERVICE PIPE | SV STEAM VALVE |
| DRAIN FACILITIES | LAND BASE FACILITIES | SURVEY CONTROL |
| AD AREA DRAIN | B BOLLARD | BM BENCH MARK |
| CB CATCH BASIN | SB SOIL BORING | SBND STONE BOUND |
| CBR CATCH BASIN ROUND | CH COAL HOLE | CAT CAT CONTROL POINT |
| CBGD CATCH BASIN D-GRATE | USP USPS MAIL BOX | CC CROSS CUT |
| DCO DRAIN CLEAN OUT | OP OBSERVATION WELL | CH DRILL HOLE |
| DLH DRAIN LAMP HOLE | PM PARKING METER | CI IRON PIPE |
| DI DROP INLET | SHR SHRUB | LP LEAD PLUG W/ BRASS TAC |
| DM DRAIN MANHOLE | SIGN SIGN | MG MASS. GEODETIC DISK |
| DLB DRAIN LEACHING BASIN | TREE TREE | PK PARKER KALON NAIL |
| ELECTRICAL FACILITIES | POLICE FACILITIES | TELEPHONE & TRAFFIC FACILITIES |
| EH ELECTRICAL HAND HOLE | PP POLICE PULL BOX | TH TELEPHONE HAND HOLE |
| EM ELECTRICAL METER PIT | PH POLICE HANDHOLE | TM TELEPHONE MANHOLE |
| ECB ELECTRICAL CONTROL BOX | PF POLICE FACILITIES | TC TELEPHONE CABINET |
| EMH ELECTRICAL MANHOLE | CS COMBINED SEWER LAMP HOLE | TB TELEPHONE BOOTH |
| ECB ELECTRICAL CABINET | CSM COMBINED SEWER MANHOLE | TP TELEPHONE PEDESTAL |
| EP ELECTRICAL PEDESTAL | SM SEWER MANHOLE | TD TELEPHONE DETECTOR |
| GA GUIDE ANCHOR | SL SEWER LAMP HOLE | TCB TRAFFIC CONTROL BOX |
| MMB MBTA MANHOLE | SV SEWER VENT | THH TRAFFIC HAND HOLE |
| EPTE ELECTRICAL PTC TEST BOX | | TS TRAFFIC SIGNAL POLE |
| ULP UTILITY POLE NO LIGHTS | SEWER FACILITIES | UNKNOWN FACILITIES |
| LPP LIGHT POLE NO UTILITIES | CSL COMBINED SEWER LAMP HOLE | UGV UNKNOWN GATE VALVE |
| ULPP UTILITY LIGHT POLE | CSM COMBINED SEWER MANHOLE | UMH MANHOLE UNKNOWN |
| FIRE FACILITIES | | |
| FPH FIRE PULL BOX | | |
| FMH FIRE MANHOLE | | |
| FHA FIRE ALARM HANDHOLE | | |



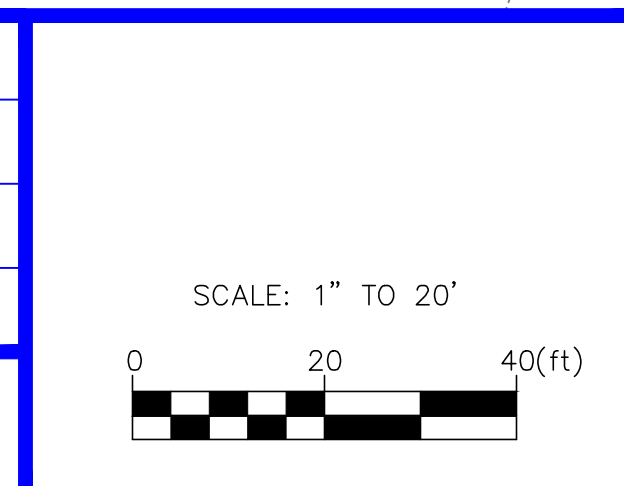
REV. NO.	DATE	DESCRIPTION	MADE BY	CHK. BY	APPD. BY

OWNER: CITY OF CAMBRIDGE		SUBSURFACE UTILITY ENGINEERING INMAN SQUARE SAFETY IMPROVEMENTS PROJECT CAMBRIDGE	
BSIES PLAN NO.: 17-3432	FILE: 17-3432UT02.DWG	PREPARED FOR KLEINFELDER 215 FIRST STREET, SUITE 320 CAMBRIDGE, MA 02142	
SUE BY: DOC/PM/SN/SBG	DRAWN BY: DOC	CHKD.: BLC	
APPROVED: JFN	DATE: 12/01/2017	SCALE: 1"=20'	CONTRACT NO.: SHEET NO.: 2 OF 3

BSI Engineering, Inc.
100 Hallet Street, Boston, MA 02124
Telephone (617) 265 4547 Fax (617) 209 1297 www.bsieng.com



REV. NO.	DATE	DESCRIPTION	MADE BY	CHK. BY	APPD. BY



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BSI Engineering, Inc.
 100 Hallet Street, Boston, MA 02124
 Telephone (617) 265 4547 Fax (617) 209 1297 www.bsieng.com

OWNER: CITY OF CAMBRIDGE	
BSIES PLAN NO.: 17-3432	FILE: 17-3432UT02.DWG
SUE BY: DOC/PM/SN/SBG	DRAWN BY: DOC
APPROVED: JFN	DATE: 12/01/2017
	SCALE: 1"=20'

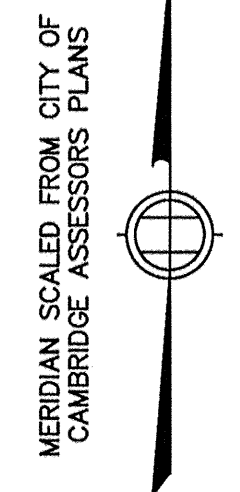
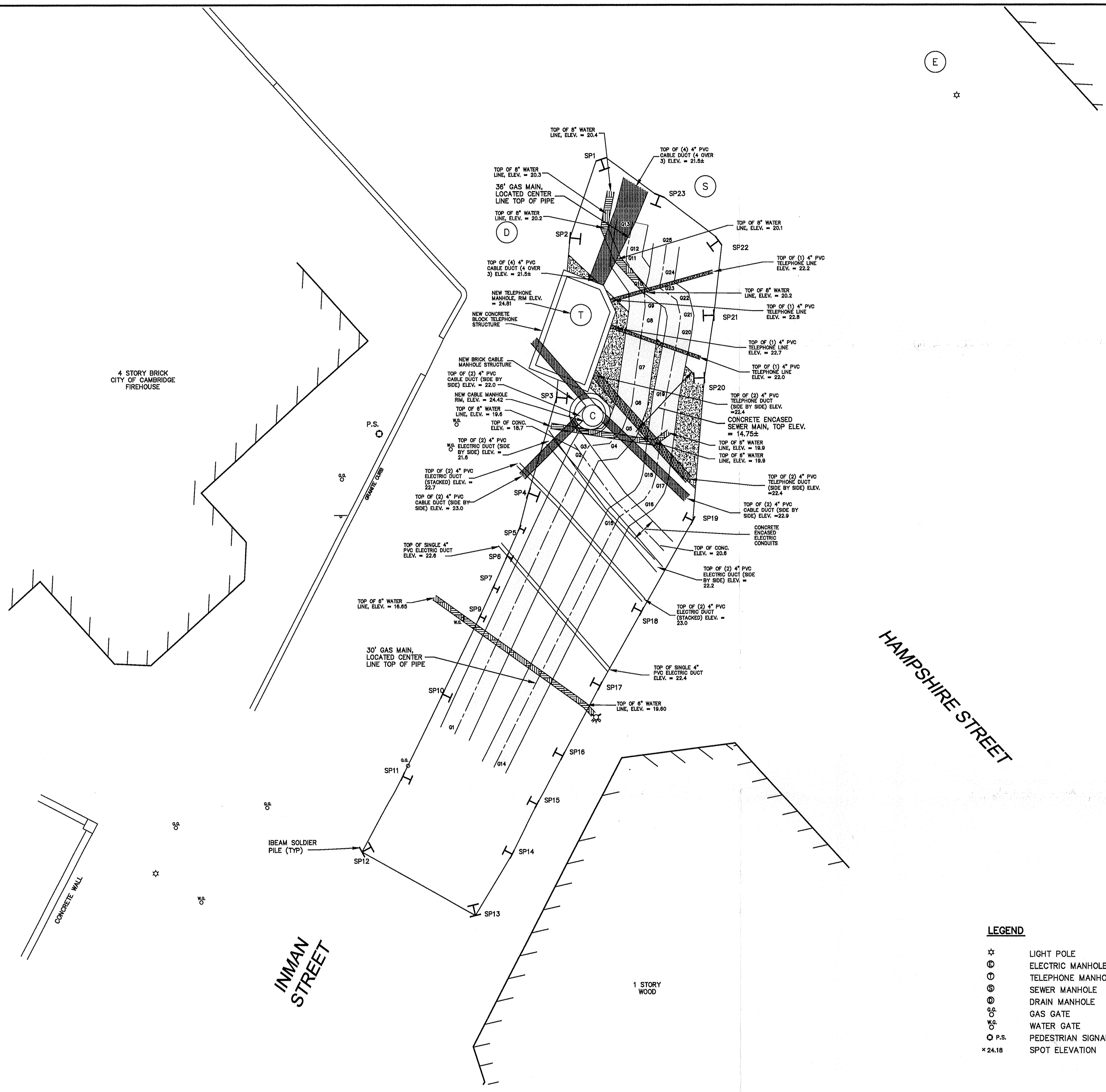
SUBSURFACE UTILITY ENGINEERING
 INMAN SQUARE SAFETY IMPROVEMENTS PROJECT
 CAMBRIDGE

PREPARED FOR
 KLEINFELDER
 215 FIRST STREET, SUITE 320
 CAMBRIDGE, MA 02142

CONTRACT NO.:	SHEET NO.: 3 OF 3
---------------	-------------------

APPENDIX E

National Grid Record Information



IBEAM SOLDIER PILE SCHEDULE	
SOLDIER PILE No.	TOP OF PILE ELEVATION
SP1	24.61
SP2	25.08
SP3	24.71
SP4	24.37
SP5	24.35
SP6	24.31
SP7	24.24
SP9	24.29
SP10	24.33
SP11	24.19
SP12	24.18
SP13	24.27
SP14	24.25
SP15	24.34
SP16	24.28
SP17	24.57
SP18	24.58
SP19	24.77
SP20	24.95
SP21	25.10
SP22	25.03
SP23	25.00

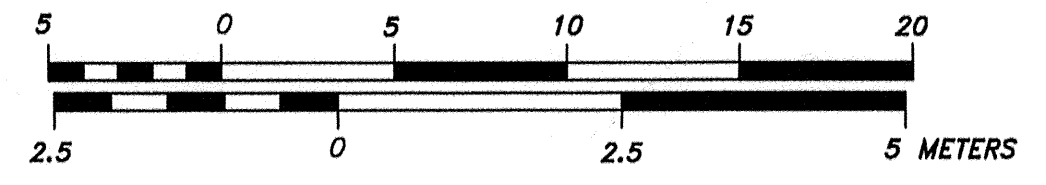
36" GAS MAIN SCHEDULE	
GAS TAG No.	TOP OF PIPE ELEVATION
G1	13.76
G2	12.63
G3	13.06
G4	16.86
G5	17.84
G6	19.23
G7	19.44
G8	18.46
G9	19.04
G10	18.20
G11	13.38
G12	12.87
G13	12.78

30" GAS MAIN SCHEDULE	
GAS TAG No.	TOP OF PIPE ELEVATION
G14	13.16
G15	12.88
G16	17.32
G17	18.13
G18	18.35
G19	18.74
G20	23.49
G21	23.13
G22	21.86
G23	12.72
G24	12.29
G25	12.57

NOTES
 THIS PLAN IS THE RESULT OF AN ACTUAL ON-THE-GROUND SURVEY PERFORMED BY DESIGN CONSULTANTS, INC. BETWEEN NOVEMBER 5 AND DECEMBER 23, 2008. IT IS INTENDED TO BE AN LIMITED EXISTING CONDITIONS PLAN SHOWING THE NEW 30", THE NEW 36" GAS MAINS AND THE OTHER UTILITIES RECONSTRUCTED IN THE GENERAL AREA OF INMAN STREET AT HAMPSHIRE STREET.
 ELEVATION ARE BASE UPON THE CITY OF CAMBRIDGE SEWER DATUM.
 TO THE BEST OF MY PROFESSIONAL KNOWLEDGE, INFORMATION, AND BELIEF, THIS PLAN CONFORMS TO THE TECHNICAL AND PROCEDURAL STANDARDS FOR THE PRACTICE OF LAND SURVEYING IN THE COMMONWEALTH OF MASSACHUSETTS.

P.L.S. _____
 MICHAEL D. BOVIO, P.L.S. MASS. REGISTRATION NO. 34609
 DATE _____

- LEGEND**
- ☆ LIGHT POLE
 - ⊕ ELECTRIC MANHOLE
 - ⊙ TELEPHONE MANHOLE
 - ⊗ SEWER MANHOLE
 - ⊘ DRAIN MANHOLE
 - ⊙ GAS GATE
 - ⊙ WATER GATE
 - ⊙ P.S. PEDESTRIAN SIGNAL
 - ×24.18 SPOT ELEVATION



Copyright 2008 Design Consultants, Inc.

P:\2008 Projects\2008-055 Inman St Cambridge\dwg\SURVEYING\08-055ab.dwg

Design Consultants, Inc.
 Consulting Engineers and Surveyors

DESIGN CONSULTANTS BUILDING
 265 MEDFORD STREET
 SOMERVILLE, MA 02143
 (617) 776-3360

SCALE:				
HORIZ: 1" = 5'				
VERT: _____				
NO.	DATE	BY	REVISIONS	
1	2-27-09	ML	REVISED SIZE OF WATER LINE, RELABLED TEL. DUCT TO CABLE DUCT	
1	1-09-09	BHS	RENUMBERED IBEAMS, ADDED HATCHING TO SEWER LINE	

FIELD: SG
 CALCS: ML
 CHECKED: BHS
 APPROVED: MDB

*** GAS LINE AS-BUILT PLAN**

*** INMAN STREET AT HAMPSHIRE STREET**

PLAN OF LAND IN
CAMBRIDGE, MASSACHUSETTS

SURVEYED FOR
NATIONAL GRID

PROJECT NO.
 2008-055

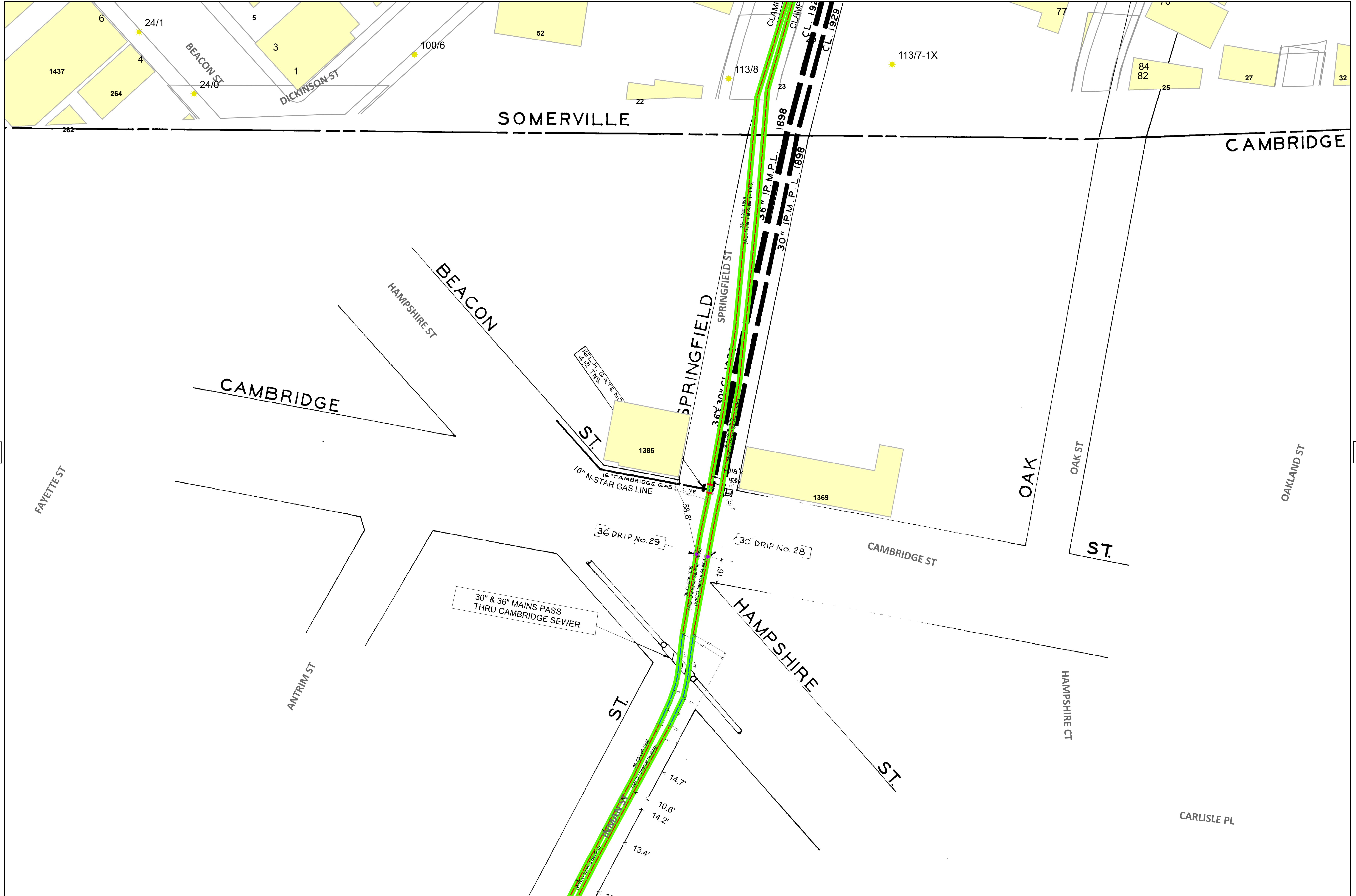
DATE: **NOV. 11, 2008**

SHEET NO.
 1 OF 1

NATIONAL GRID

SOMN1333

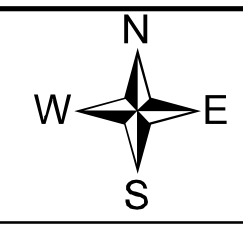
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NONE

NONE

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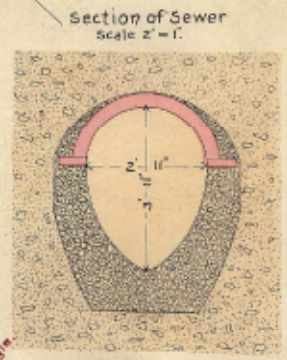
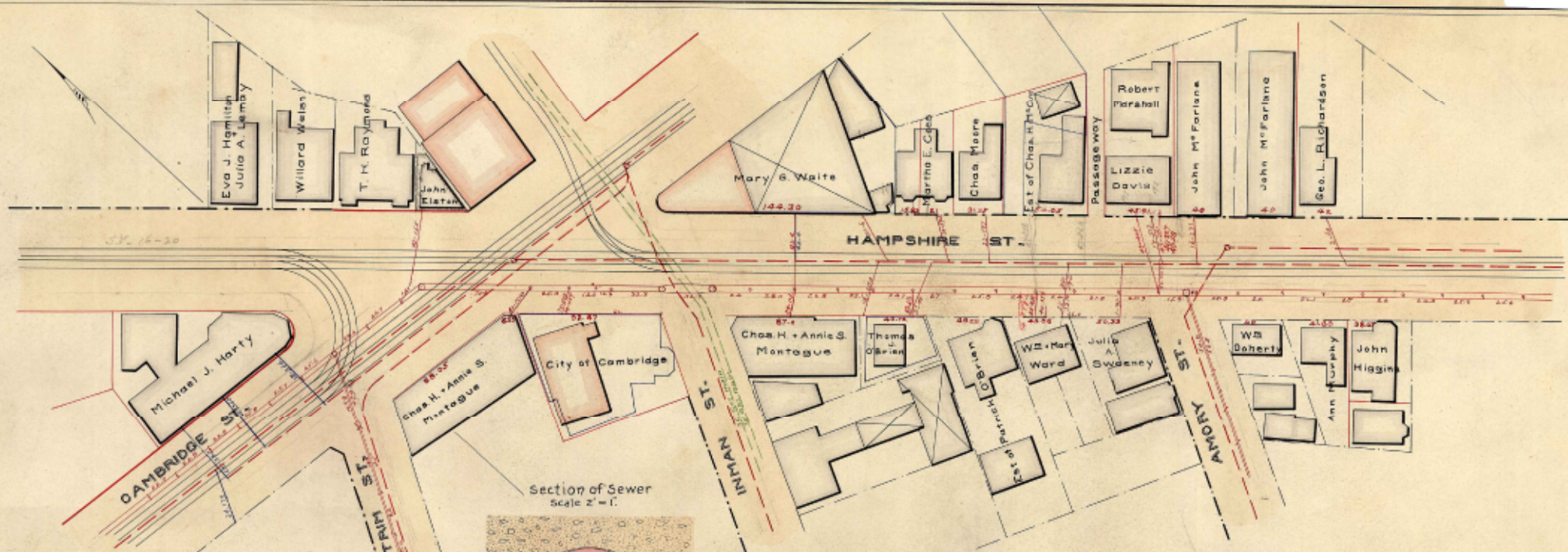


CAMN1353

NOTE1: The location of service pipes and corrosion components are not guaranteed to be correct. SPIPE, as well as original record documents, should be utilized for this information.
NOTE2: The mains in NH without dimensions are not drawn to scale. These mains are intended to show the existence of gas main on the street and do not reflect the exact location of the main in the street.

N1343

APPENDIX F
City of Cambridge
Sanitary Sewer Record Drawings
Historical Trolley Track Locations

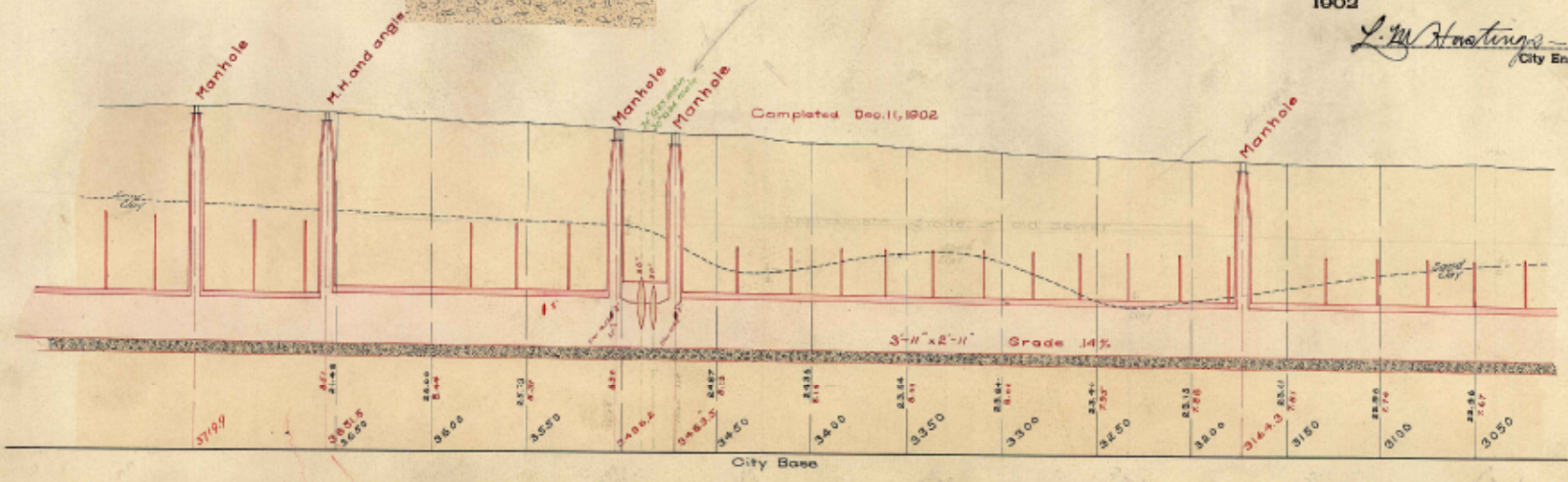


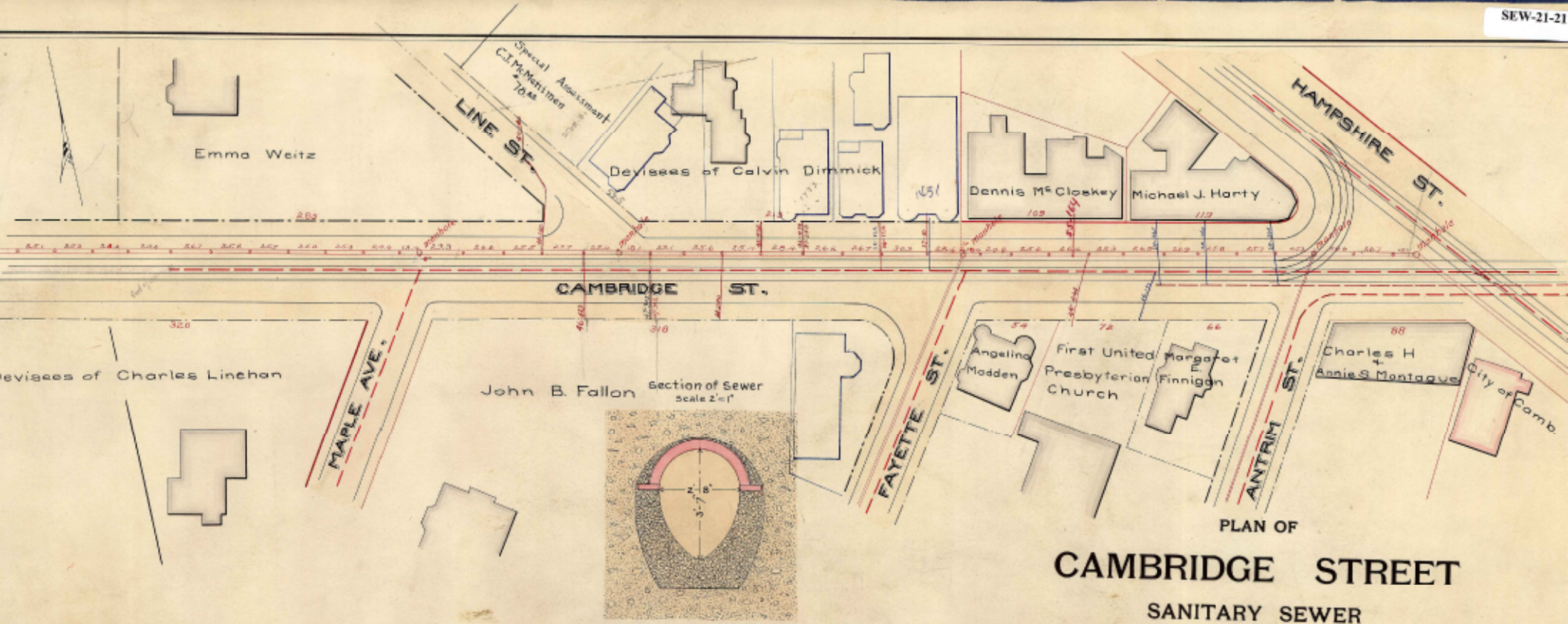
PLAN OF
Hampshire and Cambridge St.
SANITARY SEWERS

Scales, 40 and 6 feet to an inch

1902

L. M. Hastings
City Engineer



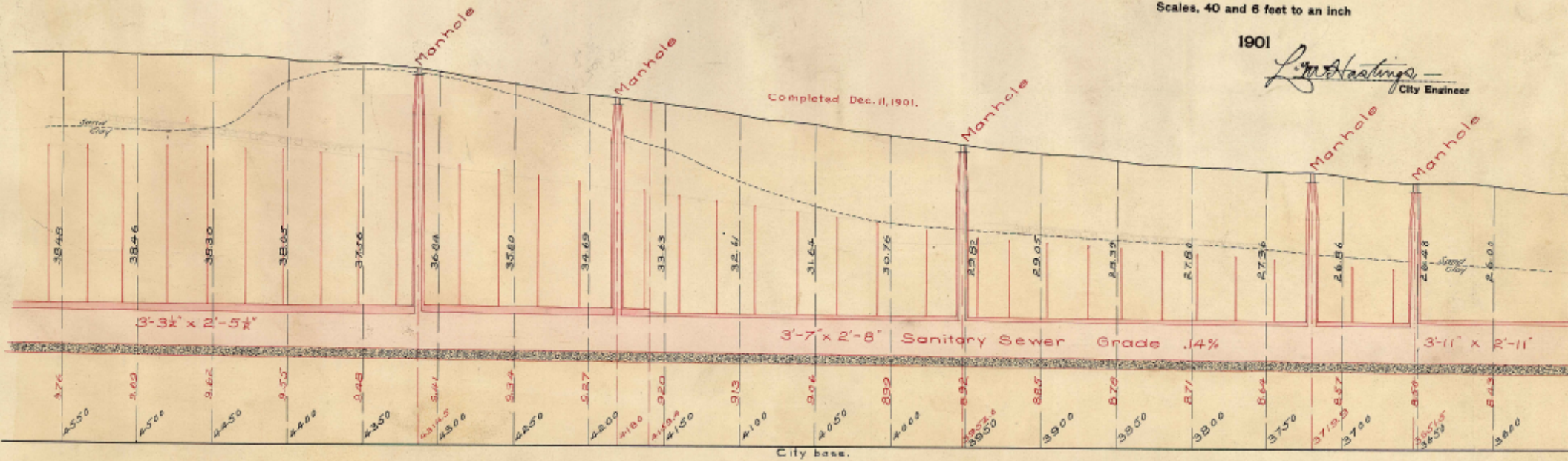


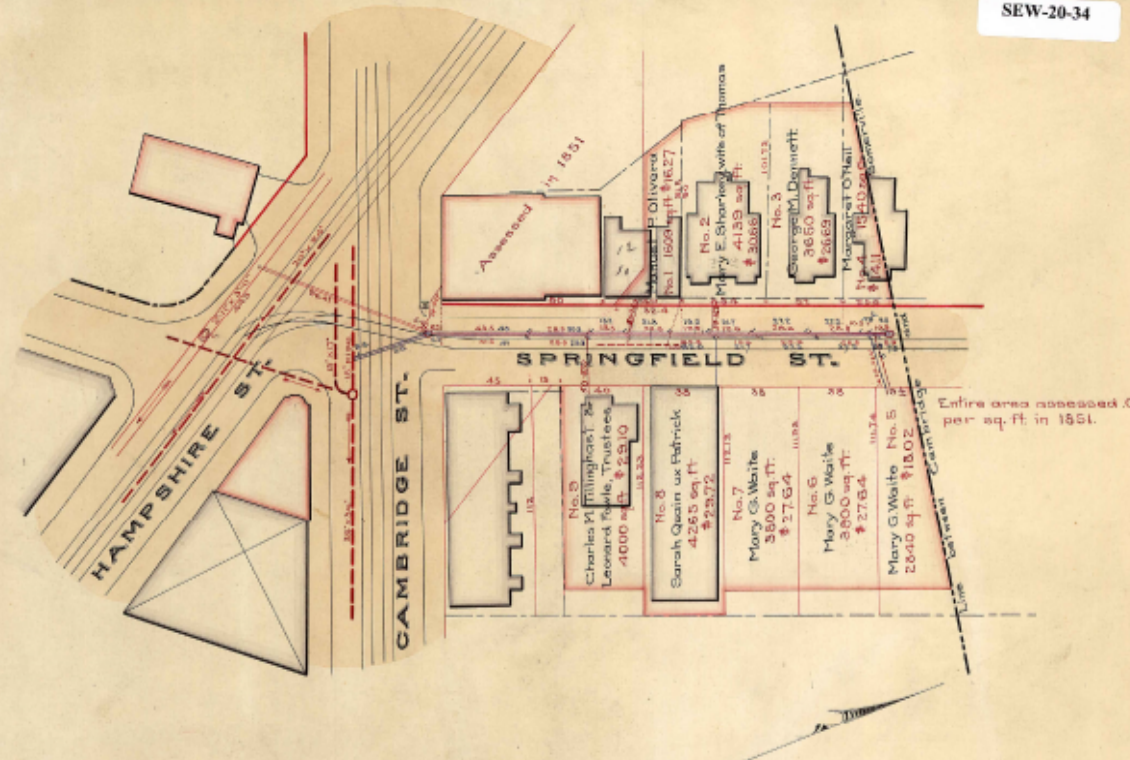
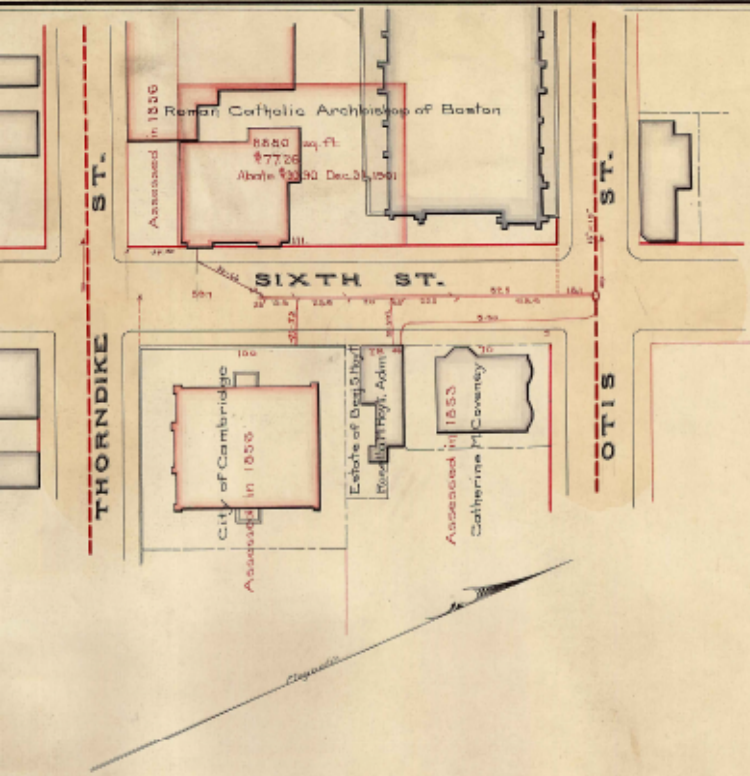
PLAN OF
CAMBRIDGE STREET
SANITARY SEWER

Scales, 40 and 6 feet to an inch

1901
L. M. Hastings
City Engineer

Completed Dec. 11, 1901.



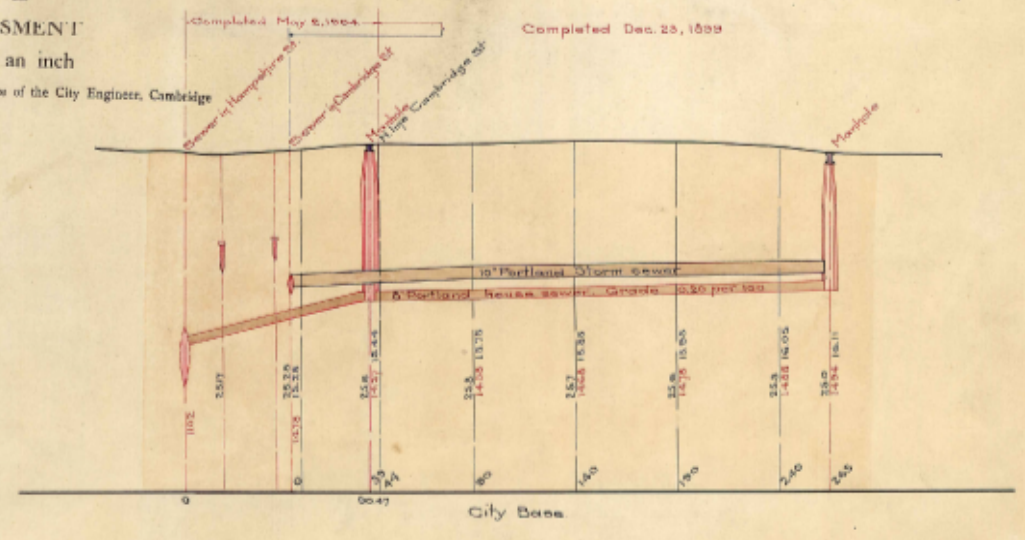
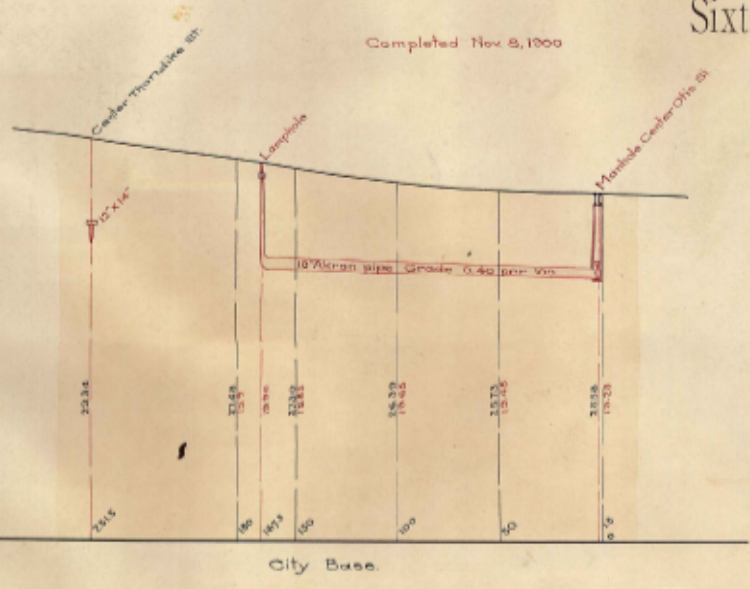


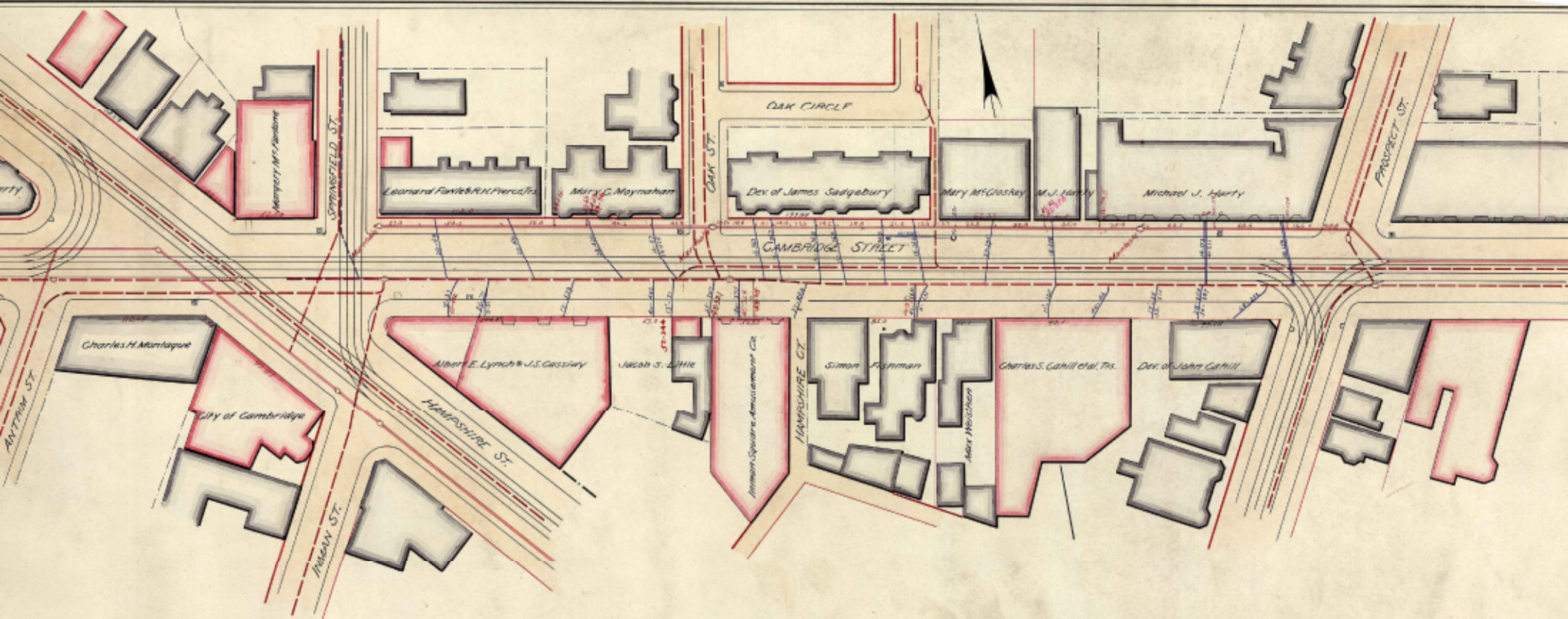
Entire area assessed .00 per sq. ft. in 1851.

PLAN OF Sixth Street and Springfield Street

SEWERS FOR ASSESSMENT
Scales 40 and 6 ft. to an inch

Office of the City Engineer, Cambridge
1900



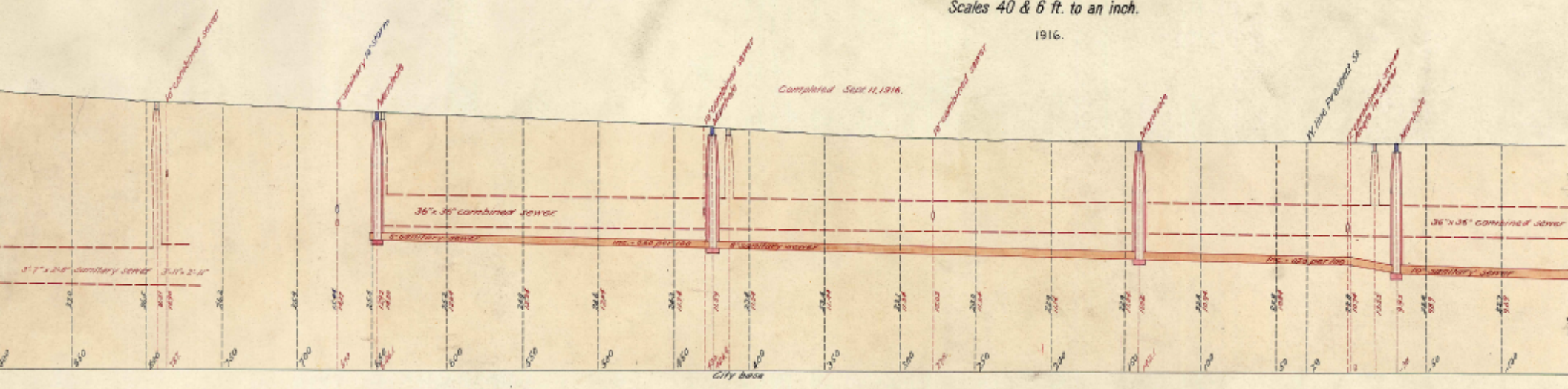


CAMBRIDGE ST.

SANITARY SEWER

Scales 40 & 6 ft. to an inch.

1916.



APPENDIX G

Memorial Sign Details

Typical Mounting Detail

Flag Mounted Panel with Square Post

3

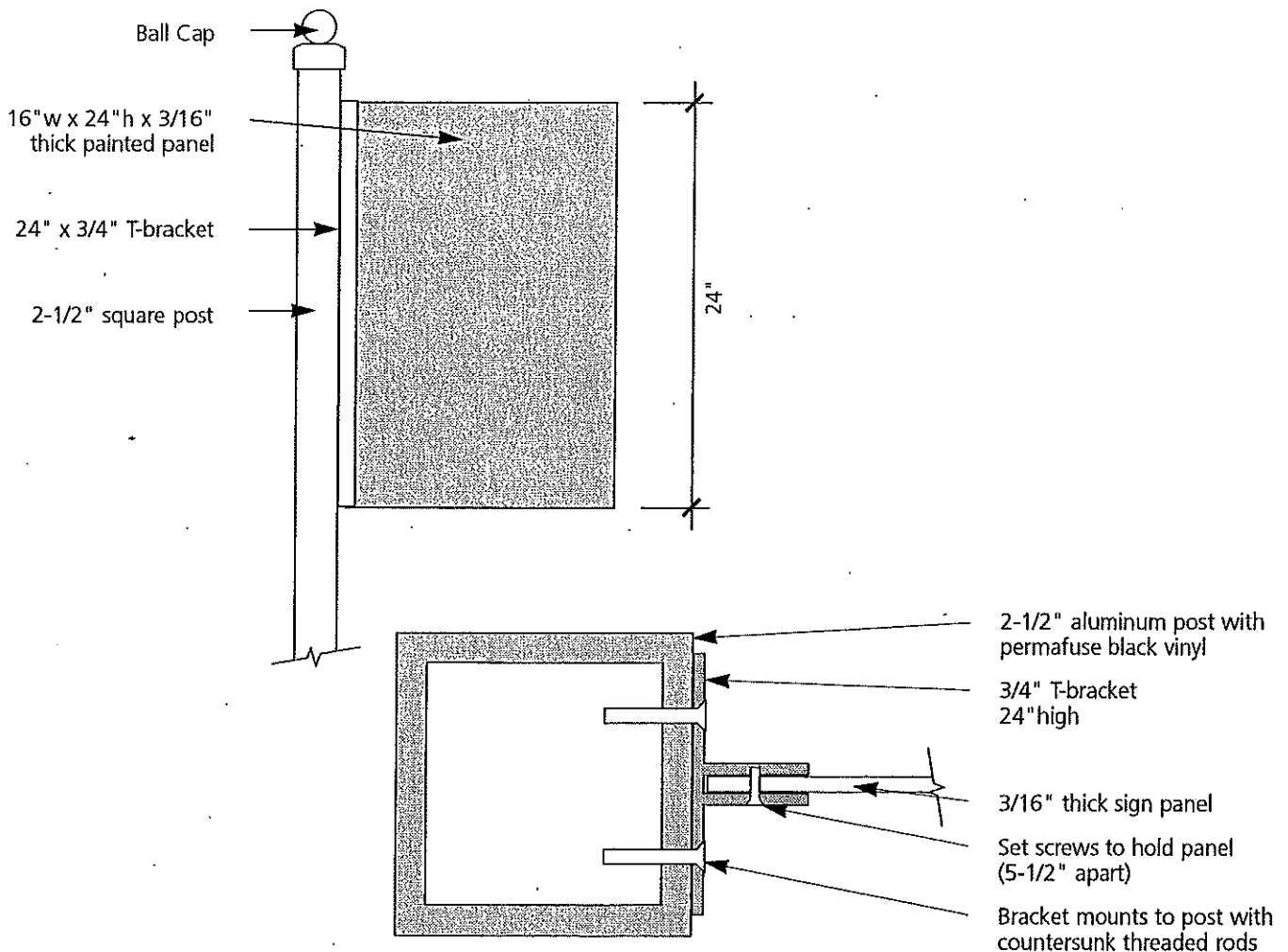
Description

16" w x 24" h x 3/16" thick Aluminum seamless panel, all exposed surfaces and mounting hardware to be painted black.

Flag-mounted to single aluminum post, 2-1/2" square, with Black permafuse vinyl coating and topped with ornamental ball cap.

Overall height of post to be 10'-3", with sign panel at 7'-9" A.F.G.

See Detail 5 for footing information.



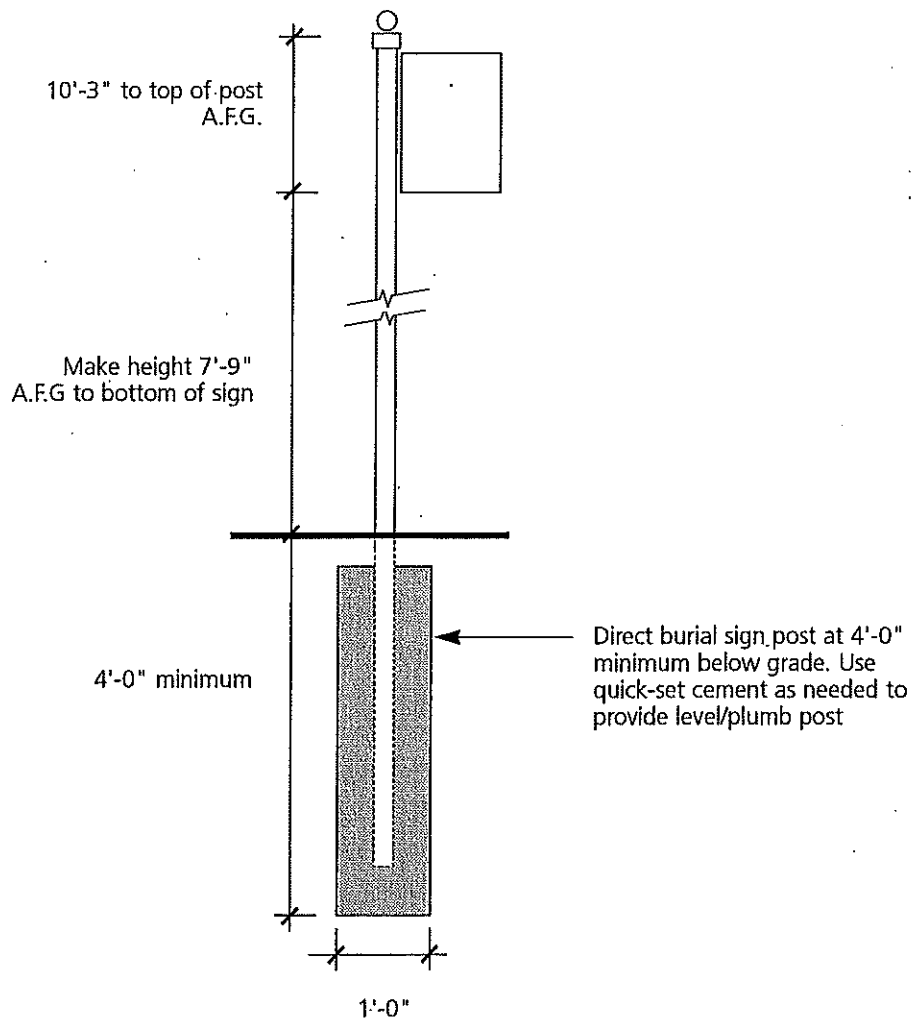
Typical Mounting Detail

Post and Panel Sign: Direct Burial

5

Description

Direct burial sign post (typical) for flag or pole mounted signs. Post locations indicated on site plans.





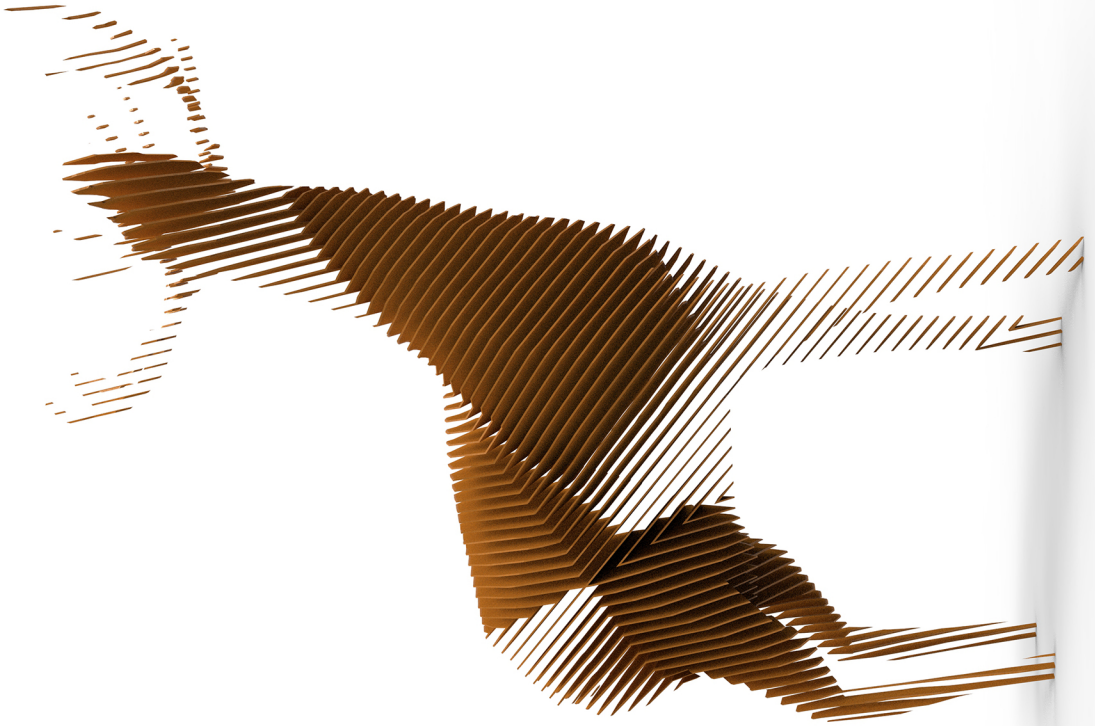
In Memory of Amanda Phillips

November 28, 1988 - June, 23 2016

“Should you meet resistance, take comfort - it’s a great way
to build muscle.”

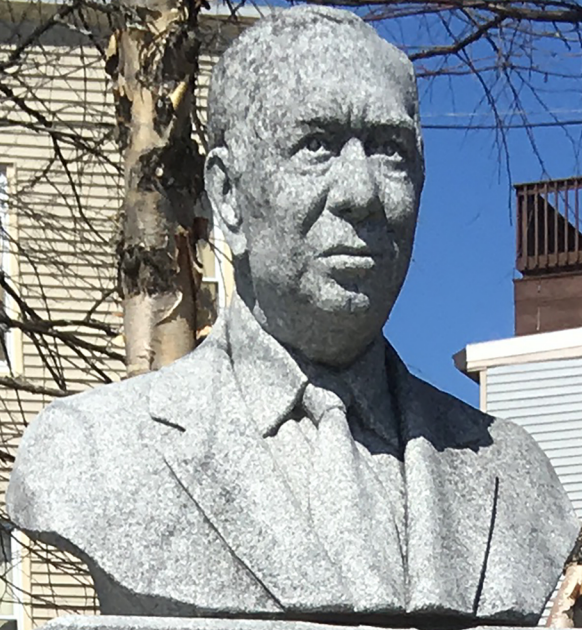
APPENDIX H

Public Art Sculpture



APPENDIX I

Photos of Mayor Vellucci Memorial



ALFRED E. VELLUCCI

MAYOR EMERITUS

— • —
IN RECOGNITION AND
GRATITUDE FROM THE
PORTUGUESE COMMUNITY

OCTOBER 15, 1995