TOWN OF PLYMOUTH
PROCUREMENT DIVISION
11 LINCOLN STREET
PLYMOUTH, MASSACHUSETTS 02360

BID 21515
SAMOSET STEET SEWER SYSTEM EXPANSION

Issued:	February 26, 2015
Pre-Bid:	March 10, 2015, at 1:00 p.m.
Due:	March 19, 2015, at 2:00 p.m.

AECOM Technical Services, Inc.
250 Apollo Drive
Chelmsford, MA 01824

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ATTACHMENT 1: Prevailing Wage Rates

ATTACHMENT 2: Technical Specifications and Plans

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TOWN OF PLYMOUTH
11 Lincoln Street
Plymouth, Massachusetts 02360

March 5, 2015

INVITATION FOR BID 21515

A. INVITATION

Sealed bids are requested by the Town of Plymouth for the Samoset Street Sewer Expansion Project. The project includes the construction of approximately 5,700 linear feet of gravity sewer and appurtenances, one (1) wastewater pumping station, approximately 2,800 linear feet of force main, and associated paving.

Bids are to be submitted by 2:00 p.m.(local time), Thursday, March 19, 2015, at which time they will be publicly opened and read. Postmarks will not be considered. All bids must be sealed and made upon forms furnished by the Procurement Division. Bids submitted on any other form will not be accepted as valid bids. Envelopes should be clearly marked "Bid 21515, Sewer System".

All work done under this Contract shall be in conformance with the latest version of the Commonwealth of Massachusetts "Standard Specifications" which hereafter shall include but not be limited to the Massachusetts Highway Department Standard Specifications for Highways and Bridges dated 1988, as amended, the Supplemental Specifications dated June 15, 2012, the 2012 Construction Standard Details, the 1996 Construction and Traffic Standard Details (as relates to traffic standard details only); the 2009 Manual on Uniform Traffic Control Devices for Streets and Highways with Massachusetts Amendments and the Standard Municipal Traffic Code; the 1990 Standard Drawings for Signs and Supports, the 1968 Standard Drawings for Traffic Signals and Highway Lighting, and the latest edition of American Standard for Nursery Stock will govern. All work done under this Contract shall also be in conformance with the Plans and these Technical Specifications.

All bids are subject to the provisions of M.G.L. Chapter 30, §39M, and these bid and contract documents.

Contract Period
The agreement shall be for the period as specified in the agreement. Time is of the essence with regard to completion of the Work required by the Contract and the work is to be completed within 260 consecutive calendar days, using no more than is 185 on-site working days. Work performed beyond the 260 consecutive calendar day period and/or 185 on-site working day period will be subject to liquidated damages in the amount specified herein.

Rule for Award:
The contract will be awarded to the responsive, responsible and eligible bidder offering the lowest total bid price, including

alternates, if any, selected by the Town.

Bid Deposit:
Bid deposit is required in the amount of five percent (5%) of the total amount of the bid, including any and all alternates. Such bid deposit shall be in the form of a Cashier's, Certified, or Bank Treasurer's check payable to the Town of Plymouth or a bid bond from a licensed surety company qualified to do business in the Commonwealth of Massachusetts and satisfactory to the Town. All bid deposits except for those of the three lowest responsible and eligible bidders shall be returned within seven days of contract award. The remaining bid deposits will be returned upon execution of a contract and presentment of all bonds by the successful low bidder.

Pre-Bid Conference:
Any person interested in submitting a bid is encouraged to inspect the premises. Arrangements have been made for such inspections on Tuesday March 10, 2015 at 1:00 PM. All inspections are to be completed during that time. Notwithstanding whether a bidder performs such an inspection, each bidder shall be deemed to have done so, and to be aware of any and all matters that are reasonably discernable from such an inspection.

MASS DOT Prequalification:
Only prospective bidders pre-qualified by the Commonwealth of Massachusetts Department of Transportation, pursuant to Section 8B of Chapter 29 of the Massachusetts General Laws, are eligible to take out official bid documents.

Prevailing Wage Rates:
This bid is subject to Section 39M of Chapter 30 and Sections 26 to 27G and Section 29 of Chapter 149 of the Massachusetts General Laws as amended, including prevailing wage rates as determined by the Commissioner of Labor and Industries that must be paid on this contract. A copy of said rates is contained herein. Each Contractor and/or subcontractor shall preserve its payroll records for a period of three (3) years from the date of completion of the contract, and shall furnish to the Commissioner within fifteen (15) days a statement of compliance, a copy of which is enclosed herein. In addition, each contractor and/or subcontract must submit a copy of their weekly payroll records to the Procurement Division on a weekly basis. A copy of the Weekly Payroll Report Form that is to be used in also included herein.

Prevailing wage rate sheets shall be updated annually. The contractor shall not be eligible for an adjustment to the contract price on account of any changes in the prevailing wage rates applicable to the project.

Labor and Materials Bond:
This bid is subject to Section 39M of Chapter 30 and Sections 26 to 27G and Section 29 of Chapter 149 of the Massachusetts General Laws as amended, including the requirement for a payment bond. The successful bidder must furnish a bond in an amount of One Hundred Percent (100%) of the total contract price for payment of labor performed or furnished and material used or employed therein, payable to the Town of Plymouth, issued by a responsible surety company qualified to do business in the Commonwealth of Massachusetts and satisfactory to the

Town, the premiums of which are to be paid by the Contractor and included in the bid price.

Performance Bond:
The successful bidder must furnish a One Hundred Percent (100%) Construction performance Bond, payable to the Town of Plymouth, issued by a responsible surety company qualified to do business in the Commonwealth of Massachusetts and satisfactory to the Town, the premiums of which are to be paid by the Contractor and included in the bid price.

GENERAL INFORMATION

A. GENERAL CONDITIONS

1. All bids shall be based on the quantities set forth in the Bid Form. These quantities shall be used as a basis for comparison of the bids. The quantities are based on estimates of the work to be performed during the term of this Contract; however, the Town does not expressly or by implication agree or warrant that the actual amount of work will correspond with such estimates and the Town reserves the right to increase or decrease the amount of any class or portion of the work as it may deem necessary, without change of price per unit, which unit prices shall be used for increases and decreases (credits) for adjustments in the quantity of work required.

2. The Town of Plymouth reserves the right to reject all bids, to waive informalities, to advertise for new bids and, if the Invitation for Bids states that more than one (1) contract may be awarded, to split awards as may be deemed to be in the best interests of the Town. The contract or contracts will be awarded by the Town within thirty (30) business days after opening bids. The Town reserves the right to require samples of materials for inspection and testing.

3. All words, signatures and figures submitted on the bid shall be in ink. Bids which are conditional, obscure or which contain additions not called for, erasures, alterations or irregularities, or any prices which contain abnormally high or low prices for any item, may be rejected. More than one bid from the same bidder will not be considered.

4. Each bid is subject to Section 39M of Chapter 30 and Sections 26 to 27G and Section 29 of Chapter 149 of the Massachusetts General Laws as amended, including but not limited to the following:

   a. Prevailing Wage Rates
      Prevailing wage rates as determined by the Commissioner of Labor and Industries must be paid on this contract. A copy of said rates is contained herein. Each Contractor and subcontractor shall preserve its payroll records for a period of three (3) years from this date of completion of the contract, and shall furnish to the Owner within fifteen (15) days of completion of its portion of the work a statement of compliance, a copy of which is enclosed herein. In addition, each contractor and/or subcontract must submit a copy of their weekly payroll records to the Town Manager's Office on a weekly basis. A copy of the Weekly Payroll Report Form that is to be used in also included herein.

      Prevailing wage rates will be updated annually; however, the contractor shall not be entitled to any additional compensation on account of any adjustments in such rates.

b. Performance Bond
The successful bidder must furnish a One Hundred Percent (100%) Construction Performance Bond, payable to the Town of Plymouth, issued by a responsible surety company qualified to do business in the Commonwealth of Massachusetts and satisfactory to the Town, the premiums of which are to be paid by the Contractor and included in the bid price.

c. Payment Bond
The successful bidder must furnish a One Hundred Percent (100%) bond for payment of labor performed or furnished and material used or employed therein, payable to the Town of Plymouth, issued by a responsible surety company qualified to do business in the Commonwealth of Massachusetts and satisfactory to the Town, the premiums of which are to be paid by the Contractor and included in the bid price.

5. Each bid shall be accompanied by a bid deposit in the amount of five (5) percent of the total bid price, including any alternates. Such bid deposit shall be in the form of a cashier's check, certified check, or bank treasurer's check payable to the Town of Plymouth or a bid bond from a licensed surety company qualified to do business in Massachusetts and satisfactory to the Town. Failure to include this bid deposit will result in the rejection of the bid. Such deposits will be returned to all except the three lowest responsible and eligible bidders within seven (7) days of contract award. The remaining bid deposits will be returned after the Town and the successful bidder have executed the Contract and such bidder has furnished all required bonds. In case of default, the bid deposit shall be forfeited to the Town.

6. The successful bidder shall comply with all applicable federal, state, and local laws and regulations.

7. The Town's policy on awarding bids to bidders with identical prices states: "When bids for goods and services are requested and received by the Town, the award is made to the lowest responsive and responsible bidder. If two or more bid prices are identical and all tied bidders are responsive and responsible, an award will be made according to the first of these three conditions to apply:

   a. Past service to the Town; if one of the tied bidders has provided this or similar service in a satisfactory manner in the past, it will be awarded to that bidder;

   b. A bidder based in Plymouth;

   c. Random selection – flip of a coin or drawing of more than two are tied."

   Each bidder, by submitting a bid, agrees to the above policy and its use in the event of a tie.

8. Purchases made by the Town are exempt from sales taxes and bid prices must exclude any such taxes. Tax exemption certificates will be furnished upon request.

9. Oral orders are not binding on the Town and deliveries made or work done without formal Purchase Order or Contract are at the risk of the Seller or Contractor and may result in an unenforceable claim.

10. "Equal" - An item "equal" to that named or described in the specifications of the contract may be furnished by the Contractor and the naming of any commercial name, trademark, item or manufacturer not mentioned by name or as limiting competition, but shall establish a standard of equality only, if and only if "or equal" is so noted. An item shall be considered equal to the item so named or described if (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 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 specifications. The name and identification of all materials other than the one specifically named shall be submitted to the Town for approval, prior to purchase, use or fabrication of such items. Subject to the provisions of Section 39J of Chapter 30 of the Massachusetts General Laws, approval shall be at the sole discretion of the Town, shall be in writing to be effective, and the decision of the Town shall be final. The Town may require tests of all materials so submitted to establish quality standards at the Contractor's expense. All directions, specifications and recommendations by manufacturers for the installation, handling, storing, adjustment and operation of their equipment shall be complied with; responsibility for proper performance shall continue to rest with the Contractor.

    For the use of material other than the one specified, the Contractor shall assume the cost of and responsibility for satisfactorily accomplishing all changes in the work as shown or as necessary. If no manufacturer is named, the Contractor shall submit the product for intended use for approval of the Town.

    Except as otherwise provided for by the provisions of Section 39J of Chapter 30 of the Massachusetts General Laws, the Contractor shall not have any right of appeal from the decision of the Town condemning any materials furnished if the Contractor fails to obtain the approval for substitution under this clause. If any substitution is more costly, the Contractor shall pay for such costs.

11. No charges will be allowed for packing, crating, freight, express, transportation, shipping or cartage. Delivery location shall be as specified in the Contract or on the Purchase Order.

12. In addition to any other rights, remedies, and warranties available to the Town: The Contractor warrants that its work shall be free of defects in materials and workmanship for a period of one year from the date of final completion/acceptance, and shall replace, repair or make good, without costs to the Town, defects or faults arising within such one (1) year period.

13. The Contractor shall not discriminate against any person on the grounds of race, color, marital status, physical disability, age, sex, sexual orientation, religion, ancestry, or national origin in

any manner prohibited by the laws of the United States, the Commonwealth, or the Town of Plymouth.

14. If funds under G.L. c. 90 are used to pay for any of the Work, a Price Adjustment clause for Hot Mix Asphalt Mixtures shall apply to the contract. (If such funds are not used, this provision shall not apply.) Municipalities are required to include price adjustment clauses for diesel fuel, gasoline, liquid asphalt, Portland cement concrete, structural steel and reinforcing steel in the bid documents of all construction contracts funded by the Massachusetts Chapter 90 Program.

    This provision applies to all hot mix asphalt mixtures containing liquid asphalt.

    The base price of liquid asphalt on the project will be a fixed price based on the date of bid opening per ton, which includes State Tax.

    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.

    The Period Price for Hot Mix Asphalt for a two (2) month period (FOB Terminal) will be determined and published by the Massachusetts Department of Transportation (MassDOT) (http://www.massdot.state.ma.us/) by averaging the prices posted at the beginning, middle, and end of each two month period by two or more suppliers.

    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, upward and downward, will be made as work is performed, using the most recent previous price adjustment Item until the applicable Period Price is established.

    The asphalt content for hot mix asphalt mixtures shall be 5.5% (0.055) by weight regardless of percentages established by the Job Mix Formula as described in Material Section M3.11.03 of the Standard Specification.

    The price adjustment will be a separate payment item. It will be determined by multiplying the number of tons of hot mix asphalt placed during each previous two month period by asphalt content percentage (0.055) times the variance in price between base price and Period Price of asphalt.

    No price adjustment will be allowed beyond the completion date of the contract, unless there is an approved extension of time by the municipality.

B. CONTRACT AWARD

Award of this bid will be made to the bidder who offers the lowest price(s) and who is deemed responsive, responsible and eligible. Determination of responsiveness and responsibility and eligibility shall be based solely on the following criteria:

1. Bidders will be deemed responsive if they complete all required forms as included in the attached bid form package to the satisfaction of the Town.

2. A bidder will be deemed responsible and eligible if:

   (1) its bid is the lowest of those bidders possessing the skill, ability and integrity necessary for the faithful performance of the work;

   (2) it 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) it shall also 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) where the provisions of Section 8B of Chapter 81 apply, the bidder shall have been determined to be qualified thereunder; and

   (5) if the bidder obtains within 10 days of the notification of contract award the security by bond required under Section 29 of Chapter 149;

   (6) if the bidder provides evidence that it has been in the business of the installation of wastewater infrastructure for municipalities in the Commonwealth of Massachusetts for at least ten (10) years;

   (7) if the bidder provides evidence of the firm’s experience by providing a list of at least ten (10) similar type, and size (or larger) wastewater infrastructure projects of which at least five (5) have included the construction of a municipal wastewater pumping station. Evidence shall include: (a) Owner’s name; (b) Owner’s contact information (name, position, address, telephone number and e-mail); (c) name of project; (d) description of the project; (e) year project completed; and (f) Engineer’s contact information (firm name, project manager/project engineer’s name, address, telephone number and e-mail); and

   (8) if the bidders provides evidence that the field superintendent to be assigned to this project has been

the superintendent on at least ten (10) similar type, and size (or larger) municipal wastewater infrastructure projects. Evidence of this experience shall a list of projects which shall include: (a) Owner's name; (b) Owner's contact information (name, position, address, telephone number and e-mail); (c) name of project; (d) description of the project; (e) year project completed; and (f) Engineer's contact information (firm name, project manager/project engineer's name, address, telephone number and e-mail).

C. INSURANCE REQUIREMENTS

1. The Contractor shall carry and continuously maintain until completion of the Contract, insurance as specified below and in such form as shall protect him performing work covered by this Contract, or the Town of Plymouth and its employees, agents and officials, from all claims an liability for damages for bodily injury, including accidental death, and for property damage, which may arise from operations under this Contract. The Contractor covenants and agrees to hold the Town and its employees, agents and officials harmless from loss or damage due to claims for personal injury and/or property damage arising from, or in connection with operations under this Contract.

2. Except as otherwise stated, the amounts of such insurance shall be for each policy, not less than:

   (1) **General Liability** of at least $1,000,000 Bodily Injury and Property Damage Liability, Combined Single Limit with a $3,000,000 Annual Aggregate Limit. **The Town and Engineer shall be named as an "Additional Insured"**. Products and Completed Operations should be maintained for up to 3 years after the completion of the project.

   (2) **Automobile Liability** of at least $1,000,000 Bodily Injury and Property Damage per accident. **The Town and Engineer shall be named as an "Additional Insured"**.

   (3) **'Workers' Compensation Insurance** as required by law.

   (4) **Property Coverage** for materials and supplies being transported by the contractor as the Town's Property Contract provides coverage for personal property within 1,000 feet of the premises.

   (5) **Umbrella Liability** of at least $5,000,000/ occurrence, $5,000,000/aggregate. **The Town and Engineer shall be named as an Additional Insured.**

3. All policies shall be so written that the Owner will be notified of cancellation or restrictive amendment at least fifteen (15) days prior to the effective date of such cancellation or amendment. A certificate from the Contractor's Insurance Carrier showing at least the coverage and limits of

liability specified above and expiration date shall be filed with the Owner before operations are begun.

4. Such certificates shall not merely name the types of policy provided, but shall specifically refer to this Contract and shall state that such insurance is required by this Contract. The Contractor shall make no claims against the Town of Plymouth or its officers for any injury to any of his officers or employees or for damage to its trucks or equipment arising out of work contemplated by this Contract.

5. The Contractor shall, to the maximum extent permitted by law, indemnify and save harmless the Town of Plymouth, its officers, agents and employees from and against any and all damages, liabilities, actions, suits, proceedings, claims demands, losses, costs and expenses (including reasonable attorney's fees) that may arise out of or in connection with the work being performed or to be performed by the Contractor, his employees, agents, sub-contractors or materialmen. The existence of insurance shall in no way limit the scope of this indemnification. The Contractor further agrees to reimburse the Town of Plymouth for damage to its property caused by the Contractor, his employees, agents, sub-contractors or materialmen, including damages caused by his, its or their use of faulty, defective or unsuitable material or equipment, unless the damage is caused by the Town of Plymouth's gross negligence or willful misconduct.

D. WITHDRAWAL OF BIDS

Except as hereinafter expressed provided, once a bid is submitted and received by the Town, the bidder agrees that he may not and will not withdraw it within thirty (30) days (Saturdays, Sundays, and legal holidays excluded) after the actual date of the opening of proposals.

Upon proper written request and identification, bids may be withdrawn only as follows:

1. at any time prior to the designated time for the opening of proposals;

2. after the designated time for the opening of bids, a bid may be withdrawn only after a contract has been signed by the successful general bidder and Owner and such bidder has furnished all required bonds. Otherwise, a bidder withdrawing its bid after such designated time shall forfeit its bid deposit.

Unless a bid is withdrawn as provided above, the bidder agrees that its bid shall be deemed open for acceptance until a contract has been executed with the low bidder and such bidder has furnished all required bonds, or until the town notifies the bidder in writing that his bid is rejected or that the town does not intend to accept it, or returns his bid deposit. Notice of acceptance of a bid shall not constitute rejection of any other bid.

E. BID STATUS INFORMATION

Addenda: If you received bid documents directly from the Town, and provided the Town with an address for delivery of addenda, the Town intends to deliver a copy of each addendum to you at such address, but the Town shall not be responsible for any failure of a bidder to receive any addenda. Notwithstanding the foregoing, bidders are solely responsible to check for and confirm their receipt of any addenda in advance of the bid deadline.

Bid results will be available over the Internet at http://www.plymouth-ma.gov/public_documents/PlymouthMA_currentbids/ Bid results will not be provided over the phone.

Notification of award of contract will be mailed to all bidders.

F. BID QUESTIONS

Please contact Pamela D. Hagler, Procurement Officer, at 508-747-1620 ext. 107, if you have any questions on the bid process. Questions regarding the project or the specifications must be submitted in writing and faxed to 508-830-4133 or emailed to phagler@townhall.plymouth.ma.us. At the discretion of the Town, questions will be answered by written addenda. Bidders may not rely upon oral responses to questions, and may rely solely upon written addenda, if any.

SPECIAL CONDITIONS

EQUIPMENT:

THE CONTRACTOR SHALL FURNISH EQUIPMENT WHICH WILL BE EFFECTIVE, APPROPRIATE AND LARGE ENOUGH TO SECURE A SATISFACTORY QUALITY OF WORK AND A RATE OF PROGRESS WHICH WILL ENSURE THE COMPLETION OF THE WORK WITHIN THE TIME STIPULATED IN THE BID FORM. IF AT ANY TIME SUCH EQUIPMENT APPEARS TO THE TOWN TO BE INEFFICIENT, INAPPROPRIATE OR INSUFFICIENT FOR SECURING THE QUALITY OF WORK REQUIRED OR FOR PRODUCING THE RATE OF PROGRESS AFORESAID, HE/SHE MAY ORDER THE CONTRACTOR TO INCREASE THE EFFICIENCY, CHANGE THE CHARACTER OR INCREASE THE EQUIPMENT, AND THE CONTRACTOR SHALL CONFORM TO SUCH ORDER. THE GIVING OR FAILURE TO GIVE SUCH ORDER BY THE TOWN SHALL IN NO WAY RELIEVE THE CONTRACTOR OF HIS/HER OBLIGATIONS TO SECURE THE QUALITY OF THE WORK AND RATE OF PROGRESS REQUIRED.

WORK HOURS:

NORMAL WORK HOURS WILL MEAN UP TO FIVE (5) 8-HOUR DAYS, MONDAY THROUGH FRIDAY. IN ORDER TO WORK HOURS NOT WITHIN THIS SPAN FOR THE CONTRACTOR'S BENEFIT, HE/SHE SHALL REQUEST A WRITTEN AUTHORIZATION TO BE APPROVED BY THE TOWN. FOR WORK OUTSIDE THE NORMAL DAY, WORK ON SATURDAYS, SUNDAYS, OR LEGAL HOLIDAYS, IF ANY WORK BEYOND THE NORMAL DAY IS TO BE PERFORMED, THE CONTRACTOR WILL RECEIVE NO EXTRA PAYMENT, AND COMPENSATION FOR SUCH WORK SHALL BE CONSIDERED AS HAVING BEEN INCLUDED IN THE PRICES AS STIPULATED FOR THE APPROPRIATE ITEMS OF WORK AS LISTED IN THE BID.

APPROVAL OF MATERIALS:

ONLY NEW MATERIALS AND EQUIPMENT SHALL BE INCORPORATED IN THE WORK. ALL MATERIALS AND EQUIPMENT FURNISHED BY THE CONTRACTOR SHALL BE SUBJECT TO THE INSPECTION AND APPROVAL OF THE TOWN, PROVIDED THAT ANY APPROVAL OR LACK OF APPROVAL SHALL NOT RELIEVE CONTRACTOR OF ITS OBLIGATIONS HEREUNDER. NO MATERIALS SHALL BE DELIVERED TO THE WORK SITE WITHOUT PRIOR APPROVAL OF THE TOWN.

THE CONTRACTOR SHALL SUBMIT DATA AND SAMPLES SUFFICIENTLY EARLY TO PERMIT CONSIDERATION AND APPROVAL BEFORE MATERIALS ARE NECESSARY FOR INCORPORATION IN THE WORK. ANY DELAY OF APPROVAL RESULTING FROM THE CONTRACTOR'S FAILURE TO SUBMIT SAMPLES OR DATA PROMPTLY SHALL NOT BE USED AS A BASIS OF A CLAIM AGAINST THE TOWN.

SUBSTITUTES OF APPROVED "OR-EQUAL" ITEMS:

WHENEVER MATERIALS OR EQUIPMENT ARE SPECIFIED OR DESCRIBED IN THE CONTRACT DOCUMENTS BY USING THE NAME OF A PROPRIETARY ITEM OR THE NAME OF A PARTICULAR SUPPLIER THE NAMING OF THE ITEM IS INTENDED TO ESTABLISH THE TYPE, FUNCTION AND QUALITY REQUIRED. MATERIALS OR EQUIPMENT OF OTHER SUPPLIERS MAY BE ACCEPTED BY THE TOWN IF SUFFICIENT INFORMATION, AS DETERMINED BY THE TOWN, IS SUBMITTED BY CONTRACTOR TO ALLOW TOWN TO DETERMINE THAT THE MATERIAL OR EQUIPMENT PROPOSED IS (1) AT LEAST EQUAL IN QUALITY, DURABILITY, APPEARANCE, STRENGTH AND DESIGN TO THE MATERIAL OR EQUIPMENT NAMED, (2) IT WILL PERFORM AT LEAST EQUALLY THE FUNCTION IMPOSED BY THE GENERAL DESIGN FOR THE WORK BEING

CONTRACTED FOR OR THE EQUIPMENT OR MATERIAL BEING PURCHASED, AND (3) IT CONFORMS SUBSTANTIALLY, EVEN WITH DEVIATIONS, TO THE DETAILED REQUIREMENTS FOR THE EQUIPMENT OR MATERIAL IN THE SPECIFICATIONS. THE PROCEDURE FOR REVIEW BY TOWN WILL INCLUDE THE FOLLOWING: REQUESTS FOR REVIEW OF SUBSTITUTE ITEMS OF MATERIAL AND EQUIPMENT WILL NOT BE ACCEPTED BY TOWN FROM ANYONE OTHER THAN CONTRACTOR. IF CONTRACTOR WISHES TO FURNISH OR USE A SUBSTITUTE ITEM OF MATERIAL OR REQUIREMENT, CONTRACTOR SHALL MAKE WRITTEN APPLICATION TO TOWN FOR ACCEPTANCE THEREOF CERTIFYING THAT THE PROPOSED SUBSTITUTE SATISFIES THE CRITERIA STATED ABOVE. THE APPLICATION WILL CERTIFY THAT THE EVALUATION AND ACCEPTANCE OF THE PROPOSED SUBSTITUTE WILL NOT DELAY CONTRACTOR'S ACHIEVEMENT OF SUBSTANTIAL COMPLETION WITHIN THE TIME STATED IN THE CONTRACT DOCUMENTS, AND MUST STATE WHETHER OR NOT ACCEPTANCE OF THE SUBSTITUTE FOR USE IN THE WORK WILL REQUIRE A CHANGE IN ANY OF THE CONTRACT DOCUMENTS, AND WHETHER OR NOT INCORPORATION OR USE OF THE SUBSTITUTE IN CONNECTION WITH THE WORK IS SUBJECT TO PAYMENT OF ANY LICENSE FEE OR ROYALTY. IF THE APPLICATION IS SILENT ON SUCH MATTERS, THE BIDDER, BY SUBMITTING AN APPLICATION, WILL BE DEEMED TO HAVE SO CERTIFIED, AND TO HAVE STATED THAT NO CHANGE IN THE CONTRACT DOCUMENTS IS NECESSARY AND NO LICENSE FEES OR ROYALTY PAYMENTS ARE REQUIRED.

ALL VARIATIONS OF THE PROPOSED SUBSTITUTE FROM THAT SPECIFIED MUST BE IDENTIFIED BY CONTRACTOR IN THE APPLICATION TOGETHER WITH AVAILABLE MAINTENANCE, REPAIR AND REPLACEMENT SERVICE FOR THE SUBSTITUTE ITEM. CONTRACTOR SHALL BE RESPONSIBLE FOR THE COSTS OF ANY NECESSARY REDESIGN AND CLAIMS OF OTHER CONTRACTORS RESULTING FROM THE PROPOSED SUBSTITUTE. TOWN MAY REQUIRE CONTRACTOR TO FURNISH AT CONTRACTOR'S EXPENSE ADDITIONAL DATA ABOUT THE PROPOSED SUBSTITUTE.

IF A SPECIFIC MEANS, METHOD, TECHNIQUE, SEQUENCE OR PROCEDURE OF CONSTRUCTION IS EXPRESSLY REQUIRED BY THE CONTRACT DOCUMENTS, THE CONTRACTOR MAY FURNISH OR UTILIZE A SUBSTITUTE MEANS, METHOD, SEQUENCE, TECHNIQUE OR PROCEDURE OF CONSTRUCTION ACCEPTABLE TO TOWN, IF CONTRACTOR SUBMITS SUFFICIENT INFORMATION TO ALLOW TOWN TO DETERMINE THAT THE SUBSTITUTE PROPOSED IS EQUIVALENT TO THAT INDICATED OR REQUIRED BY THE CONTRACT DOCUMENTS. THE PROCEDURE FOR REVIEW BY TOWN WILL BE SIMILAR TO THAT STATED PREVIOUSLY. NOTWITHSTANDING ANY ACCEPTANCE OF THE TOWN AND UNLESS OTHERWISE EXPRESSLY AGREED IN WRITING BY THE TOWN, CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DAMAGES, LOSSES, COSTS, EXPENSES, AND CLAIMS ARISING OUT OF THE SUBSTITUTE MEANS, METHOD, SEQUENCE, TECHNIQUE OR PROCEDURE.

TOWN WILL BE ALLOWED A REASONABLE TIME WITHIN WHICH TO EVALUATE EACH PROPOSED SUBSTITUTE. TOWN WILL BE THE SOLE JUDGE OF ACCEPTABILITY, AND NO SUBSTITUTE WILL BE ORDERED, INSTALLED OR UTILIZED WITHOUT TOWN'S PRIOR WRITTEN ACCEPTANCE, WHICH WILL BE EVIDENCED BY EITHER A CHANGE ORDER OR AN APPROVED SHOP DRAWING. TOWN MAY REQUIRE CONTRACTOR TO FURNISH AT CONTRACTOR'S EXPENSE A SPECIAL PERFORMANCE GUARANTEE OR OTHER SURETY WITH RESPECT TO ANY SUBSTITUTE.

TOWN WILL RECORD TIME REQUIRED BY TOWN AND TOWN'S CONSULTANTS IN EVALUATING SUBSTITUTIONS PROPOSED BY CONTRACTOR AND IN MAKING CHANGES IN THE CONTRACT DOCUMENTS OCCASIONED THEREBY. WHETHER OR NOT TOWN ACCEPTS A PROPOSED SUBSTITUTE, THE CONTRACTOR SHALL REIMBURSE TOWN FOR THE CHARGES OF TOWN'S CONSULTANTS FOR EVALUATING EACH PROPOSED SUBSTITUTE, AND SHALL, UNLESS OTHERWISE EXPRESSLY AGREED IN WRITING BY THE TOWN, BE RESPONSIBLE FOR ALL DAMAGES, LOSSES, COSTS, EXPENSES, AND CLAIMS ARISING OUT OF THE USE OF THE PROPOSED SUBSTITUTE ITEM, EQUIPMENT, MATERIAL, MEANS, METHOD, SEQUENCE, TECHNIQUE OR PROCEDURE.

TEMPORARY UTILITIES

THE CONTRACTOR SHALL MAKE ALL ARRANGEMENTS FOR AND FURNISH AT HIS/HER EXPENSE ALL WATER, ELECTRIC, TELEPHONE OR OTHER UTILITY REQUIRED BY HIM/HER FOR CONSTRUCTION PURPOSES.

LOCATION OF ALL UTILITIES

THE LOCATION OF THE EXISTING UTILITIES MUST BE ESTABLISHED AND VERIFIED BY THE CONTRACTOR. THE CONTRACTOR SHALL MAKE ARRANGEMENT WITH THE APPROPRIATE UTILITY COMPANIES TO HAVE ALL EXISTING UTILITIES MARKED ALONG THE COURSE OF THIS WORK BY SUCH MEANS AS NECESSARY. THE CONTRACTOR SHALL PRESERVE SUCH MARKED LOCATIONS UNTIL THE WORK HAS PROGRESSED TO THE POINT WHERE THE ENCOUNTERED UTILITY IS FULLY EXPOSED OR PROTECTED. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE PROPER AUTHORITIES OR UTILITY BEFORE PROCEEDING WITH THE WORK POTENTIALLY AFFECTED THEREBY.

SAFETY CONTROL

THE CONTRACTOR SHALL PROVIDE AND MAINTAIN ALL REQUIRED SAFETY EQUIPMENT SUCH AS BARRICADES, DETOUR BARRIERS AND SIGNS, LIGHTS, WALKWAYS, FENCES, FIRE PREVENTION EQUIPMENT. IF AT ANY TIME BEFORE THE COMMENCEMENT OR DURING THE PROGRESS OF THE WORK, OR ANY PART OF IT, SUCH METHODS AND PROCEDURES AS USED APPEAR TO THE TOWN AS UNSAFE, INSUFFICIENT OR IMPROPER, THE TOWN SHALL HAVE THE RIGHT, BUT UNDER NO CIRCUMSTANCES THE OBLIGATION, TO ORDER THE CONTRACTOR TO INCREASE THEIR SAFETY OF EFFICIENCY OR TO IMPROVE THEIR CHARACTER, AND THE CONTRACTOR SHALL CONFORM TO SUCH ORDERS. THE GIVING OR FAILURE OF THE TOWN TO GIVE SUCH ORDER TO INCREASE OF SUCH SAFETY, EFFICIENCY, ADEQUACY OR ANY IMPROVEMENTS SHALL NOT RELEASE THE CONTRACTOR FROM HIS/HER OBLIGATION TO SECURE THE SAFE CONDUCT AND QUALITY OF WORK SPECIFIED AND FOR ALL DAMAGES, INJURIES, LOSSES, COSTS AND EXPENSES ARISING FROM ANY FAILURE OF CONTRACTOR TO COMPLY WITH THAT OBLIGATION.

OCCUPATIONAL SAFETY AND HEALTH ACT

THE CONTRACTOR'S PARTICULAR ATTENTION IS CALLED TO THE RULES AND REGULATIONS INCLUDED IN PUBLIC LAW 91-596, KNOWN AS THE "OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970" (OSHA), AS SAME MAY BE AMENDED, SUPPLEMENTED OR SUPERSEDED.

MAINTENANCE OF TRAFFIC

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF TRAFFIC WITH THE MAXIMUM OF SAFETY AND PRACTICABLE CONVENIENCE TO SUCH TRAFFIC DURING THE LIFE OF THE CONTRACT WHETHER OR NOT WORK THEREON HAS BEEN SUSPENDED TEMPORARILY. THE WORK SHALL BE CARRIED ON IN SUCH A MANNER

AS TO PROVIDE SAFE PASSAGE AT ALL TIMES FOR PUBLIC TRAVEL AND WITH LEAST OBSTRUCTION TO TRAFFIC.

THE CONVENIENCE OF THE GENERAL PUBLIC AND OF THE RESIDENTS ALONG AND ADJACENT TO THE WORK SHALL BE PROVIDED FOR IN AN ADEQUATE AND SATISFACTORY MANNER.

PORTABLE BARRIER FENCES WITH APPROPRIATE SIGNS SHALL BE USED FOR SAFETY CONTROL IN ESTABLISHING TRAFFIC PATTERNS (DETOURS, ETC.). THESE PORTABLE BARRIER FENCES SHALL MEET THE APPROVAL OF THE DIRECTOR OF PUBLIC WORKS OR HIS/HER DESIGNEE.

ROADWAYS, DRIVEWAYS AND FOOT PATHS CLOSED TO TRAFFIC, SHALL BE PROTECTED BY SUITABLE BARRICADES AND WARNING SIGNS, AND THE CONTRACTOR SHALL PROVIDE AND MAINTAIN ADEQUATE LIGHTS AND ILLUMINATION. THEREFORE, HE/SHE SHALL BE HELD RESPONSIBLE FOR ALL DAMAGE TO THE WORK DUE TO ANY FAILURE OF SIGNS AND BARRICADES TO PROTECT THE WORK PROPERLY FROM TRAFFIC, PEDESTRIANS, ANIMAL OR OTHER CAUSES.

POLICE DETAIL

THE CONTRACTOR SHALL COORDINATE WITH THE PLYMOUTH POLICE DEPARTMENT THE NUMBER OF TRAFFIC POLICE REQUIRED IN EITHER THE APPROPRIATE TRAFFIC MANAGEMENT PLAN (TMP) TEMPLATE (SEE MASSDOT'S WEBSITE AT http://www.massdot.state.ma.us/highway/Main.aspx) OR DEEMED NECESSARY FOR THE DIRECTION AND CONTROL OF TRAFFIC WITHIN THE SITE.

THE CONTRACTOR SHALL SUBMIT THE REQUESTED AND SIGNED POLICE DETAIL SCHEDULE AS CALLED IN AND ARRANGED DIRECTLY WITH THE POLICE DEPARTMENT ON A WEEKLY BASIS. POLICE DETAILS WILL BE PAID DIRECTLY BY THE TOWN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SCHEDULING AND CANCELING POLICE DETAILS IF NOT NEEDED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CANCEL A DETAIL(S) AT A MINIMUM OF FOUR HOURS IN ADVANCE OF THE START OF THE SHIFT IF CONDITIONS SO WARRANT. POLICE DETAILS NOT CANCELLED IN TIME SHALL BE PAID FOR BY THE CONTRACTOR.

RESTORATION (WORK IN IMPROVED PROPERTY AREAS)

THE CONTRACTOR, AT HIS/HER OWN EXPENSE, SHALL CARE FOR, REPLACE, AND RESTORE ANY PUBLIC AND PRIVATE PROPERTY (E.G., SHRUBS, HEDGES, TREES, PUBLIC OR PRIVATE WAYS, SEWER DRAIN, WATER OR OTHER PIPES, CATCH BASINS, WIRES, BUILDING, FENCES, POSTS, POLES, MAILBOXES, STONE WALLS OR OTHER STRUCTURES) DAMAGED BY HIS/HER WORK, EQUIPMENT, OR EMPLOYEES, TO A CONDITION AT LEAST EQUAL TO THAT EXISTING IMMEDIATELY PRIOR TO THE BEGINNING OF OPERATIONS OR, IF BETTER, TO GOOD CONDITION, AND TO THE SATISFACTION OF THE TOWN.

THE CONTRACTOR SHALL ALSO RESTORE, AT ITS COST, TO ORIGINAL CONDITION, AND TO THE SATISFACTION OF THE TOWN, ANY LAWN OR OTHER PLANTED AREA INTERFERED WITH, INCLUDING FERTILIZING, LOAMING, AND SEEDING AS REQUIRED.

SUITABLE MATERIALS, EQUIPMENT AND METHODS SHALL BE USED FOR SUCH RESTORATION.

BOUNDS AND PROPERTY MARKERS

ALL BOUNDS AND PROPERTY MARKERS DISTURBED IN THE COURSE OF THE WORK SHALL BE REPLACED BY THE CONTRACTOR AT HIS/HER EXPENSE.

THE CONTRACTOR SHALL EMPLOY A REGISTERED LAND SURVEYOR TO RESET ALL BOUNDS AND PROPERTY MARKERS.

TELEPHONE NUMBERS

THE TELEPHONE NUMBERS OF THE FOLLOWING DEPARTMENTS OF THE TOWN OF PLYMOUTH ARE

POLICE	508-830-4220 (BUSINESS)
FIRE	508-830-4213 (BUSINESS)
HIGHWAY	508-830-4162, ext. 101
WATER	508-830-4162, ext. 138
ENGINEERING	508-747-1620, ext. 120
SEWER	508-830-4159
DIRECTOR OF PUBLIC WORKS	508-830-4162, ext. 105

TOWN OFFICE BUILDING HOURS: M - F 7:30 A.M. TO 4:00 P.M.

LEGAL REQUIREMENTS

THE CONTRACTOR SHALL KEEP HIM/HERSELF FULLY INFORMED OF, AND COMPLY WITH, ALL LAWS, ORDINANCES AND REGULATIONS OF THE FEDERAL, STATE AND MUNICIPAL GOVERNMENTS, WHICH MAY BE IN FORCE DURING THE LIFE OF THE CONTRACT, AND IN ANY MANNER AFFECTING HIS/HER EMPLOYEES OR THE CONDUCT OF THE WORK OF MATERIALS USED ON SAID WORK.

PERSONAL SUPERVISION BY CONTRACTOR

THE CONTRACTOR OR HIS/HER DULY AUTHORIZED AND APPROVED REPRESENTATIVE SHALL GIVE PERSONAL ATTENTION TO THE FULFILLMENT OF THE CONTRACT. THE CONTRACTOR SHALL HAVE ON THE WORK SITE, AT ALL TIMES, A COMPETENT FULL-TIME REPRESENTATIVE AUTHORIZED TO RECEIVE AND EXECUTE ANY ORDERS OF DIRECTION OF THE TOWN.

THE REPRESENTATIVE SHALL ALSO BE AUTHORIZED TO ACCEPT, ON BEHALF OF CONTRACTOR, ANY NOTICES GIVEN TO THE CONTRACTOR UNDER THE PROVISIONS OF THE CONTRACT.

CLEANUP

DURING THE COURSE OF THE WORK, THE CONTRACTOR SHALL KEEP THE SITE OF HIS/HER OPERATIONS IN AS CLEAN AND NEAT A CONDITION AS IS POSSIBLE. HE/SHE SHALL DISPOSE OF ALL RESIDUE RESULTING FROM THE CONSTRUCTION WORK ON A DAILY BASIS AND, AT THE CONCLUSION OF THE WORK, HE/SHE SHALL REMOVE AND HAUL AWAY STRUCTURES, AND OTHER REFUSE REMAINING FROM THE CONSTRUCTION OPERATIONS, AND SHALL LEAVE THE ENTIRE SITE OF THE WORK IN A NEAT AND ORDERLY CONDITION.

OWNER/CONTRACTOR AGREEMENT

THIS AGREEMENT made this _____day of _____, 2015, by and between the TOWN OF PLYMOUTH, with an office at 11 Lincoln Street, Plymouth, Plymouth County, Massachusetts, 02360, hereinafter called the "Owner", and **(name, street address and mailing address of contractor)** hereinafter called the "Contractor".

1. GENERAL

WITNESSETH, that the Owner and the Contractor, for the consideration hereafter named, agree as follows:

Article 1. SCOPE OF WORK: The Contractor shall perform all the Work required by the Contract Documents for the Samoset Street Sewer System Expansion as described in the Contract Documents.

Article 2. TIME OF COMPLETION: The Contractor shall commence work under this Contract on the date specified in the written "Notice to Proceed" from the Owner; and it shall bring the work to substantial completion within 260 consecutive calendar days, using no more than is 185 on-site working days. Work performed beyond the 260 consecutive calendar day period and/or 185 on-site working day period will be subject to liquidated damages in the amount specified herein.

Article 3. THE CONTRACT SUM: The Owner shall pay the Contractor in current funds for the performance of the Work, subject to additions and deductions by Change Order, the Contract Sum of _____.

Article 4. THE CONTRACT DOCUMENTS (or "CONTRACT"): The following, together with this Agreement, form the Contract and all are as fully a part of the Contract as if attached to this Agreement or repeated herein: the Advertisement, Bidding Documents, General Information, Invitation for Bids, Contract Forms, Conditions of the Contract, and Specifications as enumerated in the Table of Contents; the Drawings as enumerated in the List of Contract Drawings; Addenda; and Modifications/Change Orders issued after execution of the Contract.

By signing this Contract, the Contractor certifies under the penalties of perjury that he/she has complied with all laws of the Commonwealth relating to taxes, reporting of employees and contractors, and withholding and remitting of child support.

2. PRE-CONSTRUCTION CONFERENCE

Prior to the start of construction, the Contractor, all subcontractors, the project manager, the engineer, and the owner shall attend a pre-construction conference. The conference will serve to acquaint the participants with the general plan of contract administration; and requirements under which the construction operation is to proceed, and will inform the Contractor, in detail, of the obligations imposed on him and his subcontractors by the Executive Orders concerning Equal Employment

opportunity and Davis-Bacon Act requirements, provided that nothing said in or omitted from such pre-construction conference shall relieve Contractor of its obligations under the Contract Documents. The date, time, and place of the conference will be furnished to the Contractor by the project manager.

GENERAL CONDITIONS

3. Funding Source

This project is funded through a Town Meeting appropriation.

4. Contract Plans and Specifications

All plans, specifications and addenda, hereinafter enumerated or referenced in this contract, shall form part of this Contract and the provisions thereof shall be as binding upon the parties hereto as if they were herein set fully forth. The table of contents, titles, headings, running headlines and marginal notes contained herein and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or cast light on the interpretation of the provisions of which they refer. The plans and specifications are complimentary, and what is required by one shall be deemed as if required by all.

5. Additional Instructions and Detail Drawings

The Contractor may be furnished additional written instructions and detail drawings as necessary to carry out the work included in the contract. The Contractor shall carry out the work in accordance with the additional detail drawings and instructions. The Contractor and the Director of Public Works will prepare jointly: (a) a schedule, fixing the dates at which special detail drawings will be required, such drawings, if any, to be furnished by the Director of Public Works in accordance with said schedule, and (b) a schedule fixing the respective dates for the submission of shop drawings, the beginning of manufacture, testing and installation of materials, supplies and equipments, and the completion of the various parts of the work; each such schedule to be subject to change from time to time in accordance with the progress of the work.

6. Shop or Setting Drawings

The Contractor shall submit promptly to the Director of Public Works a minimum of four (4) copies of each shop or setting drawing prepared in accordance with the schedule predetermined as aforesaid. After examination of such drawings by the Director of Public Works or his designee and the return thereof, the Contractor shall make such corrections to the drawings as have been indicated, if any, and shall furnish the Director of Public Works or his designee with two corrected copies. If requested by the Director of Public Works or his designee, the Contractor must furnish additional copies. Regardless of corrections made in or approval given to such drawings by the Director of Public Works, the Contractor will nevertheless be responsible for the accuracy of such drawings and for their conformity to the plans and

specifications, unless he notifies the Director of Public Works in writing and conspicuously on the face of the shop drawing of any deviations at the time he furnishes such drawings, and the Director has expressly and separately approved such deviation by noting its approval on the drawing.

7. Materials, Services and Facilities

(a) It is understood that except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature and all other services and facilities of every nature whatsoever necessary to execute, complete and deliver the work within the specified time.

(b) Any work necessary to be performed after regular working hours, on Sunday or Legal Holidays, shall be performed without additional expense to the Owner.

8. Contractor's Title to Materials

No materials or supplies for the work shall be purchased by the Contractor or by any Subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials and supplies used by him in the work, free from all liens, claims or encumbrances.

9. Title to Work

The title to all work completed and in the course of construction, and of all material incorporated into the work, and all material not incorporated into the work but for which any payment has been made by Owner shall be in the Owner's name.

10. Inspection and Testing of Materials

(a) All materials and equipment used in the construction of the project shall be subject to inspection and testing in accordance with accepted standards.

(b) Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

11. Express Warranty

The Contractor guarantees to Owner that all materials incorporated into the work will be new and of recent manufacture unless otherwise expressly specified or agreed in writing. Contractor also guarantees that all work will be done in a workmanlike manner, free from defects in material and workmanship, and in strict conformance with all requirements and specifications in the Contract.

12. Maintenance and Guarantee

The Contractor hereby guarantees that the entire work constructed by him under the contract will meet fully all requirements thereof as to quality of workmanship and of materials furnished by him. The Contractor hereby agrees, in addition to any other rights and remedies available to the Town, to make at his own expense any repairs or replacements made necessary by defects in materials or workmanship supplied to him that become evident within one (1) year after the date of the final payment, and to restore to full compliance with the requirements set forth herein for any part of the work constructed hereunder, which during said one (1) year period is found to be deficient with the respect to any provisions of the specifications. The Contractor also agrees to indemnify and hold harmless the Owner from claims of any kind arising from damage due to said defects. The Contractor shall make all repairs and replacements promptly upon receipt of written orders for same from the Owner. If the Contractor fails to make the repairs and replacements promptly, the Owner may do the work and the Contractor shall be liable to the owner for the cost thereof. The foregoing is not a limitation of, but is in addition to, any other rights and remedies available to the Owner, and nothing herein shall reduce or limit any applicable statutory limitations periods for suits by the Owner.

13. "Or Equal" Clause

Whenever a materials, article or piece of equipment is identified on the plans or in the specifications by reference to manufacturers' or vendors' trade names, catalogue numbers, etc., it is intended merely to establish a standard; and, any materials, article or equipment of other manufacturers and vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article or equipment so proposed is, in the opinion of the Director of Public Works, at least equal in quality, durability, appearance, strength and design, 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 conforms substantially, even with deviations, to the detailed requirements for the item in the said specifications. It shall not be purchased or installed by the Contractor without the Director's written approval.

14. Survey's Permits and Regulations

The Contractor shall be responsible for all additional surveys/layouts necessary for the execution of the work.

The Contractor shall procure and pay for all permits, licenses and approvals necessary for the execution of his contract.

The Contractor shall strictly comply with all laws, ordinances, rules, orders and regulations relating to performance of the work, the protection of adjacent property and the maintenance of passageways, guard fences or other protective facilities.

15. Contractor's Obligations

The Contractor shall and will, in a good and workmanlike manner,

do and perform all work and furnish all supplies and materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, necessary and/or proper to perform and complete all the work required by and reasonably inferable from this Contract, within the time herein specified, in strict accordance with the provisions of this Contract and said specifications and in accordance with the plans and drawings covered by this Contract any and all supplemental plans and drawings, and in accordance with the directions of the Director of Public Works as given from time to time during the progress of the work. He shall furnish, erect, maintain and remove such construction plant and such temporary works as may be required.

The Contractor shall observe, strictly comply with, and be subject to all terms. conditions, requirements and limitations of the Contract and specifications, and shall do, carry on and complete the entire work to the satisfaction of the Director of Public Works and the Owner.

16. Weather Conditions

In the event of temporary suspension of work, or during inclement weather, or whenever the Director of Public Works shall direct, the Contractor will, and will cause his Subcontractors to protect carefully his and their work and materials against damage or injury from the weather. If, in the opinion of the Director of Public Works or his designee, any work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any of his Subcontractors so to protect his work, such materials shall be removed and replaced at the expense of the Contractor.

17. Protection of Work and Property-Emergency

The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with the Contract. He shall at all times safely guard and protect his own work, and that of adjacent property from damage. The Contractor shall replace or make good any such damage, loss or injury to the extent caused, in whole or in part, directly or indirectly, by Contractor, its employees, subcontractors or suppliers or any person for whom Contractor is responsible.

In case of an emergency which threatens loss or injury of property, and/or safety of life, the Contractor will be allowed to act, without previous instructions from the Director of Public Works, in a diligent manner to address such emergency. He shall notify the Director of Public Works immediately thereafter. Any claim for compensation by the Contractor due to such extra work shall be submitted for consideration to the Director of Public Works in writing within 21 days of the onset of the emergency.

18. Inspection

The authorized representatives and agents of the Owner shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials and other relevant data and records at any reasonable time with or without notice.

19. Reports, Records and Data

The Contractor shall submit to the Owner such schedule of quantities and costs, progress schedules, payrolls reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under the Contract.

20. Superintendence by Contractor

At the site of the work, the Contractor shall employ a construction superintendent or foreman who shall have full authority to act for the Contractor. It is understood that such representative shall be acceptable to the Director of Public Works, or designee, and shall be one who can be continued in that capacity for the particular job involved unless he ceases to be on the Contractor's payroll, provided that any approval or lack of approval of the Director of any such representative shall not relieve Contractor of its obligations hereunder.

21. Changes in Work

No changes in the work covered by the approved Contract Documents shall be made without having prior written approval of the Owner. Charges or credits for the work covered by the approved change shall be determined by one or more or a combination of the following methods, at the sole election of Owner:

(a) Unit bid prices previously approved.

(b) An agreed lump sum.

(c) The actual cost of:

(1) Labor, including foremen.
(2) Materials entering permanently into the work.
(3) The ownership or rental cost of construction plant and equipment during the time of use on the extra work.
(4) Power and consumable supplies for the operation of power equipment.
(5) Insurance.
(6) Wages to be paid.

To the cost under (c) there shall be added a fixed fee to be agreed upon but not to exceed fifteen percent (15%) of the actual cost of work. The fee shall be compensation to cover the cost of supervision, overhead, bond, profit and any other general expenses.

22. Time for Completion and Liquidated Damages

It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for substantial completion of the work to be done hereunder are ESSENTIAL CONDITIONS of the Contract; and it is further mutually understood and agreed that the work embraced in this Contract shall be commenced on the date specified in a "Notice to Proceed" to be issued by the Owner.

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

If the said Contractor shall neglect, fail or refuse to substantially complete the work within the time herein specified, or any property extension thereof granted by the Owner, then the Contractor does hereby agree, as a partial consideration for the awarding of this Contract, to pay to the Owner the amount specified below, not as a penalty, but as liquidated damages for each and every calendar day the Contractor shall be in default after the time stipulated in the Contract for substantially completing the work.

The said amount of liquidated damages is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would sustain in such event and said amount shall be retained from time to time by the Owner from current periodic estimates.

It is further agreed that time is of the essence of each and every portion of this Contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract as additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this contract.

Notwithstanding the foregoing, and notwithstanding anything to the contrary in the Contract Documents, the Owner may, at its sole election and in its sole discretion, recover its actual damages in lieu of liquidated damages for any delay caused in whole or in part, directly or indirectly, by Contractor, its employees, subcontractors, suppliers or any person for whom Contract is responsible.

In the event Contractor is delayed through no fault of its own, it may make claim for an extension of time (only) as follows: The Contractor shall within ten (10) days from the earlier of the date of the event giving rise to its claim, the date on which the delay commenced, or the date on which Contractor knew or should have known of its claim, notify the Owner in writing of the existence

and causes of the delay, and request an extension of time to complete the work and include therein the length of extension requested, and shall provide such other information as the Owner may reasonably request. Failure to comply strictly with the above notice procedure shall result in the waiver of any such claim. In addition, Contractor agrees that in the event it initiates any proceeding against Owner on account of any delays or the assessment of liquidated damages and Contractor is found to have failed to strictly comply with the aforesaid notice process, Contractor shall pay Owner's attorneys' and expert witness fees incurred in defending any such proceeding. Notwithstanding the foregoing, any decision of the Owner or its designee on any claim of Contractor for an extension of time to complete the work shall be final and binding on the Contractor under G.L. c. 30, § 39J.

The amount of liquidated damages for this project shall be the sum of $2,500 for each consecutive calendar day or $2,500 for each working day thereafter. If the Contractor exceeds the number of working days allowed, the sum of $2,500 per working day shall be assessed. If the Contractor exceeds the number of calendar days allowed, the sum of $2,500 per calendar day shall be assessed. If the Contractor exceeds the number of working days and the number of calendar days allowed, the sum of $5,000 per day shall be assessed.

23. Correction of Work

All work, all materials, whether incorporated in the work or not, all processes of manufacture, and all methods of construction shall be at all times and places subject to the inspection of the Director of Public Works or his designee who shall be the final judge of the quality and suitability of the work, materials, processes of manufacture and methods of construction for the purposes for which they are used. Should they fail to meet his approval they shall be forthwith reconstructed, made good, replaced and/or corrected, as the case may be, by the Contractor at his own expense. Rejected materials shall immediately be removed from the site. If, in the opinion of the Director of Public Works, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the Contract Documents, the compensation to be paid to the Contractor hereunder shall be reduced by such amount as in the judgment of the Director shall be equitable.

24. Subsurface Conditions Found Different

Should the Contractor encounter subsurface and/or latent physical conditions at the site materially differing from those shown on the plans or indicated in the specifications for which an equitable adjustment is required under G.L. c. 30, § 39N, he shall immediately upon discovering such conditions and before disturbing same give written notice to the Director of Public Works of such conditions. The Director of Public Works will thereupon promptly investigate the conditions, and if he finds that they materially differ from those shown on the plans or indicated in the specifications and an equitable adjustment is required by G.L. c. 30, § 39N, an appropriate change order shall be prepared for such

adjustment in accordance with Paragraph 21, above, including any credits to Owner and/or additional compensation to Contractor, as the case may be. Notwithstanding the foregoing, Contractor will be eligible for an equitable adjustment on account of said conditions if and only if such adjustment is required by G.L. c. 30, § 39N.

Failure to comply with the notice procedure stated above shall result in the waiver of Contractor's claim. Moreover, any decision of the Owner or its designee on any claim of the Contractor under this paragraph shall be final and binding on the Contractor under G.L. c. 30, § 39J. Contractor agrees that in the event it initiates any proceeding against Owner on account of any claim for equitable adjustment due to subsurface or latent physical conditions for which Contractor had failed to strictly comply with the aforesaid notice process, Contractor shall pay Owner's attorneys' and expert witness fees incurred in defending any such proceeding.

25. Right of the Owner to Terminate Contract

The Owner may terminate this Contract by providing the Contractor with ten (10) days written notice for the reasons stated below:

(a) Violation of any of the provisions of this Contract by the Contractor or any of his/her subcontractors, or of any federal, state or local law or regulation applicable to the project work.

(b) A determination by the Owner that the Contractor has engaged in fraud, waste, mismanagement, misuse of funds, or criminal activity with any funds provided by this Contract.

(c) Failure of the Contractor, for any reason, to fulfill in a timely and proper manner its obligations under this Contract, including timely prosecution and completion of the work unless an extension of time to complete the work has been granted by the Owner via a signed Change Order.

The Owner shall not be required to give notice of termination to Contractor's surety, if any, provided that nothing herein shall preclude Owner from making claim on any performance bond issued by any surety.

If the Owner determines that a continuation of work on the project would endanger the life, health, or safety of those working or living at or near the project site, or that immediate action is necessary to protect public funds and/or property, the Owner may suspend work or terminate this agreement by providing notice to the Contractor in the form of telegram, mailgram, hand-carried letter, or other appropriate written means.

Owner may also terminate the Contractor for its convenience, including for no reason, upon 30 days' written notice. In the event of any such termination, Contractor shall be paid for all work satisfactorily performed to the date of termination. Contractor shall not be entitled to any lost profits or other damages.

26. Payments to Contractor

(a) Provided an agreed upon form of application for payment is received by the fifth day of the month, not later than the twentieth (20th) day of each calendar month the Owner shall make a progress payment to the Contractor on the basis of a duly certified and approved estimate of the work performed during the preceding calendar month under this Contract, less five percent (5%) of the amount of each estimate until final completion and acceptance of all work covered by this Contract, and the value of any claims of the Owner against Contractor.

(b) In preparing estimates, the material delivered and properly stored on the site may be taken into consideration if and to the extent approved by Owner.

(c) Notwithstanding any certification or lack of certification by the Owner or its agents or representatives, the Owner may withhold the value of its claims against the Contractor from amounts otherwise payable to Contractor.

27. Indemnification

The Contractor shall comply with the requirements of all applicable laws, rules and regulations in connection with the services of the Contractor, and shall exonerate, indemnify and hold harmless the Owner's officers, agents, and all employees from and against them, and local taxes or contributions imposed or required under the Social Security, Worker's Compensation, and Income Tax laws. Further, the Contractor shall exonerate, indemnify and hold harmless the Owner with respect to any damages, expenses or claims arising from or in connection with any of the work performed or to be performed under this Contract. This obligation of the Contractor is in addition to, and shall not be construed as a limitation of, the Contractor's liability under any other provision of the Contract or law and any other rights and remedies available to the Owner.

28. Acceptance of Final Payment Constitutes Release

The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor. No payment, however, final or otherwise, shall operate to release the Contractor or his Sureties from any obligations under the Contract or the performance and payment bond.

29. Insurance

The Contractor shall not commence work under this Contract until he has obtained all the insurance required in the Bidding Document and such insurance has been approved by the Owner, nor shall the Contractor allow any Subcontractor to commence work on this subcontract until the insurance required of the subcontractor has been so obtained and approved.

30. Assignments

The Contractor shall not assign or subcontract the whole or any part of this Contract or any monies due or to become due hereunder without written consent of the Owner. In case the Contractor assigns, with Owner’s consent, all or any part of any monies due or to become due under this Contract, the assignee shall be bound by the terms of the Contract Documents and its right, if any, in and to any monies due or to become due to the Contractor shall be subject to, among other things, prior claims of all the Owner, and of all persons, firms and corporations of services rendered or materials supplied for the performance of the work called for in this Contract.

31. Authority of the Director of Public Works

Where ever the Contract Documents there is a reference to the Director of Public Works, such reference shall be to the Director or his designee, which may be an independent third-party engineer retained by Owner. The Director of Public Works or his designee shall give all orders and directions contemplated under this Contract and specifications relative to the execution of the work.

The Director or his designee shall determine the amount, quality, acceptability and fitness of the several kinds of work and materials which are to be paid for under the Contract and shall decide all questions which may arise in relation to the interpretation of the Contract Documents, said work and the construction thereof. The Director's estimates and decisions shall be final and conclusive under G.L. c. 30, § 39J. In case any question shall arise between the parties hereto relative to said Contract and specifications, the determination or decision of the Director shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this Contract affected in any manner or to any extent by such question.

The Director or his designee shall decide the meaning and intent of any portion of the specifications and of any plans or drawings where the same may be found obscure or be in dispute, which decision shall be final and binding as aforesaid.

32. Notice and Service Thereof

Any notice to any Contractor from the Owner relative to any part of this Contract shall be in writing and considered delivered and the service thereof completed, when said notice is posted, by certified or registered mail or by other method of delivery for which a delivery receipt is generated (including facsimile or e-mail, if a deliver receipt is generated), to the said Contractor at his last given address, or delivered in person to the said Contractor or his authorized representative on the work.

33. Subcontract

The Contractor will insert in any subcontracts provisions making the subcontractors responsible to the Contractor in the same manner as Contractor is responsible to the Owner under the Contract Documents.

34. Suspension of or Delays to the Work: No Damages for Delay

Notwithstanding anything to the contrary in the Contract Documents, if the Contractor or the work is delayed through no fault of Contractor for any reason, including, but not limited to, acts of the Owner, Contractor's sole remedy, if any, shall be an extension of time to complete the work, provided Contractor makes a claim for such an extension in strict accordance with the process set forth in paragraph 22, above. Under no circumstances shall the Contractor be entitled to make or assert or recover for any claim for damages by reason of any such delay, whether such a claim is characterized as one for delay, having to perform out-of-sequence work, or loss of production, or otherwise.

35. Access to Records

The Contractor shall maintain accounts and records, including personnel, property and financial records, adequate to identify and account for all costs pertaining to the Contract and such other records as may be deemed necessary by the Town to assure proper accounting for all project funds. These records will be made available for audit purposes and/or inspection to the Owner or its designee or any authorized representative, and will be retained by Contractor for three years after final completion of all work.

36. Non-Discrimination

The Contractor shall not discriminate in violation of any applicable federal, state and local law or regulation, including the following: Title VI of the Civil Rights Act of 1964 (Public Law 88-352), and the regulations issued pursuant thereto by HUD (24 CFR Part 1); Title VIII of the Civil Rights Act of 1968 (Public Law 90-284), as amended; Section 109 of the Housing and Community Development Act of 1974, and the HUD regulations issued pursuant thereto (24 CFR 570.601); Federal Executive Order 11063, as amended by Executive Order 12259 and the HUD regulations issued pursuant thereto (24 CFR 107); Executive Order 11246 and the rules, regulations and relevant orders of the U.S. Secretary of Labor, if applicable; The Age Discrimination Act of 1975 (42 U.S.C. 6101 et seq.); Section 402 of the Veterans of the Vietnam Era Act. Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794); Massachusetts General Laws Chapter 151B, section 1 et seq.; State Executive Order 74 as amended and revised by Executive Orders 116,143 and 227, and EOCD regulation, procedures or guidelines; Title II of the Uniform Relocation Assistance and Real Property, Acquisition Policies Act of 1979; and EOCD guidelines, procedures, or regulations.

The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, handicap, or national origin. Noncompliance by the Contractor with the non- discrimination clauses of this Contract shall constitute a material breach of the Contract.

37. Termination of Contract

In addition to any other rights of Owner to suspend or terminate

the Contract: The Owner may suspend or terminate this Contract by providing the recipient with ten (10) days written notice for failure of the Contractor, for any reason, to fulfill in a timely and proper manner its obligations under this Contract including compliance with applicable federal, state or local laws or regulations.

38. Schedule of Salaries and Wages

The minimum wage rates and health and welfare fund contributions applicable to this Contract as determined by the Director, Division of Occupational Safety, Commonwealth of Massachusetts under the provisions of the Massachusetts General Laws, Chapter 149, Sections 26 and 27D, inclusive as amended are attached hereto and incorporated herein. The greater of Federal wage rates or State prevailing wage rates, when both are applicable, shall be paid under this contract and reported as required.

39. Labor Provisions

(a) In the employment of mechanics and apprentices, teamsters, chauffeurs and laborers by the Contractor and Subcontractors, preference shall first be given to citizens of the Commonwealth who have been residents of the Commonwealth for at least six months at the commencement of their employment, who are male veterans as defined in clause forty-third of G.L. c. 4, s. 7 and who are qualified to perform the work to which the employment relates; and secondly, to citizens of the Commonwealth generally who have been residents of the Commonwealth for at least six months at the commencement of their employment, and if they cannot be obtained in sufficient numbers, then to citizens of the United States, in accordance with G.L. c. 149, s. 26.

(b) The minimum rates of wages to be paid mechanics and apprentices, chauffeurs, teamsters and laborers shall be set forth in the schedule of rates of wages determined by the Commissioner of Labor and Industry.

(c) In accordance with G.L. c. 149, s 34A, the Contractor shall, before commencing performance of the contract, provide by insurance for the payment of compensation and the furnishing of other benefits under chapter one hundred and fifty-two to all persons to be employed under the contract, and the Contractor shall continue such insurance in full force and effect during the terms of the contract. Sufficient proof of compliance with this section must be furnished at the time of execution of this contract. Failure to provide and continue in force such insurance as aforesaid shall be deemed a materials breach of the contact and shall operate as an immediate termination thereof. The attention of the Contractor is directed to that portion of G.L. c. 149, s. 34A which provides that whoever violates any of its provisions shall be punished by a fine of not more than one hundred dollars or by imprisonment for six months, or both; and, in addition, any Contractor who violates any provision of this section shall be prohibited from contracting, directly or indirectly, with the Commonwealth or any political subdivision

thereof for the construction, alteration, demolition, maintenance or repair of, or addition to, any public works or public building for a period of two years from the date of conviction of said violation.

(d) The Contractor shall pay to any reserve police officer employed by him prevailing rate of wage paid to regular police officers, as required by G.L. c. 149, s. 34B.

40. Environmental Requirements

The Contractor shall comply, where applicable, with: Federal Executive Order 1199218, Floodplain Management, May 24, 1977 (42 FR 26951 et. seq.) particularly section 2 (a); the Coastal Zone Management Act of 1972 (16 U.S.C. 1451 et. seq.), as amended, particularly section 307 (c) and (d) (16 U.S.C. 1456 (c) and (d); the Safe Water Drinking Act of 1974 (42 U.S.C. 201, 300 (f) et seq., and 21 U.S.C. 349), as amended; the Endangered Species Act of 1973 (16 U.S.C. 1531 et. seq.) as amended, particularly section 7 (16 U.S.C. 1536; the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271 et. seq.) as amended, particularly section 7 (b) and (c) (16 U.S.C. 1278 (b) and (c); the Clean Air Act (42 U.S.C. 7401 et seq.) as amended, particularly section 176 (c) and (d) (42 U.S.C. 7506 (c) and (d)); HUD Environmental Criteria and Standards (44 FR 40860-40866, July 12, 1979); "The American Standard Specification for Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped," Number A-117.4-R 1971, subject to the exceptions contained in 41 CFR 101-19-604; and any corresponding provisions of State and local laws and regulations.

The Contractor shall also comply, where applicable, with the National Environmental Policy Act of 1969, Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, Flood Disaster Protection Act of 1973, National Flood Insurance Act of 1968, and Protection of Wetlands Laws.

41. Historic Preservation

The Contractor shall, in the performance of any environmental assessments under the National Policy Act, and the Massachusetts Environmental Policy Act, comply with section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470), Federal Executive Order 11593, and the Preservation of Archaeological and Historic Data Act of 1966 (17 U.S.C. 469 a-1 et seq.), by (a) consulting with the State Historic Preservation Officer to identify properties listed in or eligible for inclusion in the National Register of Historic Places that are subject to adverse effect (see 36 CFR Part 800.8) by the proposed activity, and (b) complying with all requirements established by HUD to avoid or mitigate adverse effects upon such properties.

42. Interest of Contractor and Employees

The Contractor covenants that he presently has no interest and shall not acquire interest, direct or indirect, that violates or will with the passage of time result in a violation of G.L. c. 268A. The Contractor further agrees that in the performance of this contract, no person having any such interest in violation of

said law shall be employed.

43. Severability

If any provision of this Agreement is held invalid, the remainder of the Agreement shall not be affected thereby, and all other parts of this Agreement shall nevertheless be in full force and effect.

44. Claims for Additional Compensation

In the event the Contractor believes it is due additional compensation for extra work or otherwise, except for claims on account of subsurface and latent physical conditions, which claims shall be made as stated above, the Contractor shall, within ten (10) days from the earlier of the date of the event giving rise to its claim, the date on which the delay commenced, or the date on which Contractor knew or should have known of its claim, submit its claim in writing to the Owner, describing in reasonable detail the basis of the claim, the event giving rise to the claim, and an itemization of the additional compensation requested. Notwithstanding the foregoing, if such claim is for extra work, such claim must be submitted before the alleged extra work is performed.

Failure to comply strictly with the above notice procedure shall result in the waiver of any such claim. In addition, Contractor agrees that in the event it initiates any proceeding against Owner on account of any claims for additional compensation and Contractor is found to have failed to strictly comply with the aforesaid notice process, Contractor shall pay Owner’s attorneys’ and expert witness fees incurred in defending any such proceeding. Notwithstanding the foregoing, any decision of the Owner or its designee on any claim of Contractor for additional compensation shall be final and binding on the Contractor under G.L. c. 30, § 39J.

45. In the event of any conflict or inconsistency between and among the provisions of the Contract Documents, the provision resulting in the greatest quantity and better quality of goods and services or, if the foregoing does not resolve the conflict or inconsistency, the provision resulting in less cost or risk to the Owner, as reasonably determined by the Owner, shall control. Any decision of the Owner or its designee on such resolution shall be final and binding on the Contractor under G.L. c. 30, § 39J.

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CONTRACTUAL LIABILITY

To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify, and hold harmless OWNER and its consultants, agents and employees from and against all claims, damages, losses and expenses, direct, indirect or consequential (including but not limited to fees and charges of designers, architects, attorneys and other professionals and court and arbitration costs) arising our of or resulting from performance of the Work, provided that any such claim, damage, loss or expense(s) 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 (b) is caused in whole or in part by any negligent act or omission of CONTRACTOR, any subcontractor, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work 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 or arises by or is imposed by Law and Regulations regardless of the negligence of any such party.

In any and all claims against OWNER or any of its consultants, agents or employees by any employee of CONTRACTOR, and subcontractor, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, the indemnification obligation under the above paragraph shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for CONTRACTOR or any such subcontractor or other person or organization under workers' or workmen's compensation acts, disability benefit acts or other employee benefits acts.

Policies for General Liability, Automobile Liability, Workers’ Compensation Insurance, and Umbrella Liability shall remain in effect during the one year correction period.

Such insurance as is herein certified applies to all operations of the insured in connection with, and necessary and incidental to, the work herein described at the locations stated.

It is hereby understood and agreed that the above policies will not be restrictively amended, materially changed nor canceled without 30 days advance notice by registered mail to OWNER.

_____ _____

Authorized Representative Signature Address
(Include Evidence of Authorization)

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BID FORM

_____
NAME OF BIDDER

Bids must be submitted on this form and the following table. Bids submitted on any other form will not be considered valid. Please return this form and the attached forms to:

Town of Plymouth
ATTN: Procurement Division
Town Office Building
11 Lincoln Street
Plymouth, MA 02360

Bids must be received by 2:00 p.m., Thursday, March 19, 2015. Postmarks will not be considered. All bids will be publicly opened and read at the above address, date and time. Prices are to include any delivery charges unless otherwise specified. All offers are subject to Bid 21515 Documents.

In compliance with the above, the undersigned offers and agrees, if this offer is accepted within thirty (30) business days from date of receipt of offers specified above, to perform the herein described work for the prices offered opposite each item and that said prices will be good for the period of one year.

The undersigned bidder hereby certifies:

Bidder has visited the site(s), carefully read and examined the drawings and project manual herein referred to and knows and understands the terms and provisions therein

Bidder agrees that if this bid is accepted he/she will contract with the Owner, as provided for in the bid/contract documents, and that he/she will perform all the work and furnish all bonds, the material and equipment and provide all labor, services, plant, machinery, apparatus, appliances, tools, supplies, and all other things required by the documents in the manner and within the time therein prescribed and according to the requirements of the Town as therein set forth and that he/she will take in full payment therefor, the lump sum applicable to the project as offered below.

The bid is based upon the payment to laborers to be employed on the project of wages in an amount not less than the applicable prevailing wage rates established for the project by the Massachusetts Division of Occupational Safety. The undersigned bidder agrees, in addition to any other rights and remedies available to the Awarding Authority, to indemnify the Awarding Authority for, from and against any loss, expense, damages, actions or claims, including any expense incurred in connection

with any delay or stoppage of the project work, arising out of or as a result of (1) the failure of the said bid to be based upon the payment of applicable prevailing wage rates or (2) the failure of the bidder, if selected as the Contractor, to pay laborers employed on the project the said applicable prevailing wage rates.

No person in the employ of the Town of Plymouth has any pecuniary interest in this proposal or in the contract for the work, which is proposed.

The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on 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 that he will comply fully with all laws and regulations applicable to awards made subject to G.L. c.149, §44A.

THE UNDERSIGNED BIDDER HEREBY CERTIFIES UNDER THE PAINS AND PENALTIES OF PERJURY THE FOLLOWING:

This bid in all respects is bonafide, 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.

It has complied with all laws of the Commonwealth relating to taxes, reporting of employees and contractors, and withholding and remitting child support in accordance with MGL Chapter 62C, Section 49A.

It 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 provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

All structural works should be priced installed with appropriate finishing works. Shop drawings may be required for any additional design work.

The Bidder understands and agrees that the estimated quantities for unit price pay items are not guaranteed, are approximate only, and are included solely for the purpose of comparison of bids, and that it shall be paid no more than its unit prices for all unit price work, even if such work greatly exceeds the estimated quantities. The Bidder also understands and agrees that the Owner does not expressly or by implication guaranty or warrant the nature and extent of the

materials or conditions that may be encountered below the surface of the ground.

SAMOSET STREET SEWER SYSTEM EXPANSION, AS SPECIFIED. PRICES SHALL INCLUDE ALL LABOR, EQUIPMENT AND MATERIALS NECESSARY TO COMPLETE THE PARTICULAR ITEM AS SPECIFIED AND NO ADDITIONAL COMPENSATION WILL BE ALLOWED.

Quantities listed are estimates only and not guaranteed to approximate the actual amounts to be used.

ITEM #	DESCRIPTION	EST. QUAN.	UNIT	UNIT PRICE	TOTAL AMOUNT
1.	Mobilization/Demobilization, (not to exceed five percent of the Total Bid Amount exclusive of Item 1) as specified	1	LS		
2A.	Furnishing and installing 8-inch PVC gravity sewer, less than 8 feet in depth, as specified	300	LF		
2B.	Furnishing and installing 8-inch PVC gravity sewer, 8 to 12 feet in depth, as specified	1,530	LF		
2C.	Furnishing and installing 8-inch PVC gravity sewer, over 12 feet in depth, as specified	720	LF		
2D.	Furnishing and installing 10-inch PVC gravity sewer, less than 8 feet in depth, as specified	840	LF		
2E.	Furnishing and installing 10-inch PVC gravity sewer, 8 to 12 feet in depth, as specified	400	LF		
2F.	Furnishing and installing 10-inch PVC gravity sewer, over 12 feet in depth, as specified	590	LF		
2G.	Furnishing and installing 12-inch PVC gravity sewer, less than 8 feet in depth, as specified	650	LF		
2H.	Furnishing and installing 12-inch PVC gravity sewer, more than 8 feet in depth, as specified	250	LF		
2I.	Furnishing and installing 15-inch PVC gravity sewer, all depths, as specified	150	LF		
2J.	Furnishing and installing 12-inch DI gravity sewer, all depths, as specified	120	LF		
2K.	Furnishing and installing 3-inch PVC LPS, all depths, as specified	800	LF		
2L.	Furnishing and installing 8-inch DI force main, all depths, as specified	2,730	LF		
2M.	Furnishing and installing 6-inch PVC gravity sewer service connections as specified	680	LF		
2N.	Furnishing and installing PVC wyes and tees as specified	26	ea		

ITEM #	DESCRIPTION	EST. QUAN.	UNIT	UNIT PRICE	TOTAL AMOUNT
2O.	Furnishing and installing Type 1 Cleanouts as specified	26	ea		
3A.	Furnishing and installing manholes, 4-feet in diameter without frame and cover, less than 8 feet in depth, as specified	13	ea		
3B.	Furnishing and installing manholes, 4-feet in diameter without frame and cover, 8 to 12 feet in depth, as specified	6	ea		
3C.	furnishing and installing manholes, 4-feet in diameter without frame and cover, over 12 feet in depth, as specified	4	ea		
3D.	Furnishing and installing manholes, 5-feet in diameter without frame and cover, all depths, as specified	4	ea		
3E.	furnishing and installing flushing drain manholes including watertight frames and covers, all depths, as specified	3	ea		
3F.	Furnishing and installing air vacuum and air release valve manholes including standard frames and covers, all depths, as specified	3	ea		
4A.	Furnishing and installing standard manhole frames and covers as specified	27	ea		
4B.	Furnishing and installing watertight manhole frames and covers, as specified	6	ea		
5.	Interior manhole drop connections – Not Used				
6.	Furnishing and installing PVC chimneys, as specified	40	VF		
7.	Furnishing and placing miscellaneous cement concrete (not part of another bid item), as specified	200	CY		
8.	Rock and/or boulder excavation, including replacement with suitable fill material, as specified	20	CY		
9A.	Excavation of unsuitable material below trench grade and/or subgrade of structures and pipes, including replacement with suitable fill material, as specified	950	CY		
9B.	Excavation of unsuitable material above trench grade and/or subgrade of structures and pipes, including replacement with suitable fill material, as specified	1,820	CY		
10.	Experimental excavation and backfill, as specified	320	CY		
11.	Fill for embankments – not used				
12.	Sheeting and/or shoring ordered left in place – not used				
13.	Performing soil compaction testing, as specified	30	ea		

ITEM #	DESCRIPTION	EST. QUAN.	UNIT	UNIT PRICE	TOTAL AMOUNT
14.	Road base course material including furnishing and placing, as specified	1,240	CY		
15A.	Furnishing and placing 2-inch temporary bituminous concrete trench resurfacing, as specified (minimum of $65/ton)	420	ton		
15B.	Furnishing and placing permanent bituminous concrete trench resurfacing, on Grissom Road, as specified (minimum of $65/ton)	120	ton		
15C.	Furnishing and placing permanent bituminous concrete trench resurfacing, on Samoset Street as specified (minimum of $65/ton)	840	ton		
15D.	Furnishing and placing permanent bituminous concrete trench resurfacing, on Pilgrim Hill Road, as specified (minimum of $65/ton)	420	ton		
15E.	Furnishing and placing 2-inch permanent bituminous concrete full width resurfacing, as specified (minimum of $65/ton)	3,480	ton		
15F.	Furnishing and placing miscellaneous bituminous concrete pavement, as specified (minimum of $65/ton)	180	ton		
15G.	Milling of existing bituminous concrete pavement, as specified	31,000	SY		
16A.	Removing and relaying or replacing existing storm drains, as specified	5,600	in-ft		
16B.	Removing and relaying or replacing existing water mains, as specified	7,800	in-ft		
17.	Uniformed Police Officers – Refer to Section 01025, Measurement and Payment				
18A.	Furnishing, installing and subsequent removal of the Engineer's Field Office, as specified	1	LS		
18B.	Maintaining the Engineer's Field Office, as specified	30	wks		
19.	Furnishing, installing, maintaining and removing sedimentation control barrier, as specified	1,110	LF		
20.	Furnishing, installing, operating, maintaining and removing trench dewatering equipment, as specified	200	LF		
21A.	Samoset Street Sewer System Expansion Pump Station, as specified, the sum of as specified	1	LS		
21B.	Planting/Scrub at Pump Station and Temporary Storage Yard Cost, as specified	Allowance		$15,000	$15,000
21C.	Electric Company Connection/Service Fee , as specified	Allowance		$25,000	$25,000
21D.	Telephone Company Connection/Service Fee, as specified	Allowance		$7,500	$7,500
21E.	Gas Company Connection/Service Fee, as specified	Allowance		$20,000	$20,000

TOTAL OF ITEMS 1-21E $ -

TOTAL (IN WORDS)

_____

_____

NOTES:

A. All prices, except item totals, shall be stated in both words and figures. Discrepancies between unit prices and their respective total amounts will be resolved in favor of the unit price. Quantities are estimated. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

B. BASIS OF AWARD - The Basis of Award shall be the sum of Items 1 through 21, inclusive.

C. Bidder hereby agrees to commence Work under this Contract within ten (10) consecutive calendar days after a date to be specified in DOCUMENT 00650, NOTICE TO PROCEED and complete the project within 260 consecutive calendar days (using no more than 185 on-site working days) thereafter, unless the time for completion is extended otherwise by the Contract Documents. Work performed beyond this Contract time period (Completion) shall be subject to liquidated damages. Bidder further agrees to pay, as liquidated damages, the sum of $2,500 for each consecutive calendar day or $2,500 for each working day thereafter, as provided in Article 15 of DOCUMENT 00700, GENERAL CONDITIONS. If the Contractor exceeds the number of working days allowed, the sum of $2,500 per working day shall be assessed. If the Contractor exceeds the number of calendar days allowed, the sum of $2,500 per calendar day shall be assessed. If the Contractor exceeds the number of working days and the number of calendar days allowed, the sum of $5,000 per day shall be assessed.

D. Interlineations, alteration or erasure may void the bid. All prices shall be typewritten or written by hand in ink

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

F. Bidder further certifies under penalties of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth of Massachusetts under the provisions of M.G.L. c.29, s.29F, or any other applicable debarment provisions of any other chapter of the General Laws or

any rule or regulation promulgated thereunder.

G. Bidder also certifies that it has visited the site(s), received and reviewed the Drawings and Project Manual (Bidding Documents, Conditions and Technical Specifications) dated June 2014 (Revised January 2015) and titled, Contract No. 2014-Phase 1, Samoset Street Sewer System Expansion, Plymouth, MA.

H. The Bidder hereby certifies that it is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the Work and that it will comply fully with all laws and regulations applicable to awards made in the Commonwealth of Massachusetts, including the weekly submission of certified payroll records to the Owner.

I. The successful Bidder shall submit for review by the Owner documentation to establish a “direct labor mark-up” for change orders which may be executed.

J. This Bid must bear the written signature of the Bidder or an authorized agent of the Bidder. If the Bidder is a corporation or a partnership, the Bid must be signed by a duly authorized officer of such corporation or by a partner and the title of such officer must be stated.

K. The Bidder pursuant to M.G.L.c.62C, s.49A certifies under the penalties of perjury that it, to its best knowledge and belief, complied with all laws of the Commonwealth relating to taxes, reporting of employees and contractors and withholding and remitting of child support.

L. 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 M.G.L. c.29, s.29F, or any other applicable provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

M. The Owner reserves the right to withhold the fair market value for work not completed. In addition to the retainage on work completed as described in DOCUMENT 00855, SPECIAL CONDITIONS, COMMONWEALTH OF MASSACHUSETTS. Unbalanced bid items will specifically be subject to review and to this potential withholding from periodic payment applications.

THE UNDERSIGNED ACKNOWLEDGES RECEIPT OF ADDENDA #_____*
*To be filled in by bidder if addenda are issued.

PLEASE NOTE ANY EXCEPTIONS ON SEPARATE CONTRACTOR LETTERHEAD.

BIDDER _____

_____

_____

COUNTY _____

STATE OF INCORPORATION _____

PHONE _____

FAX _____

E-MAIL _____

TAX I.D. NUMBER _____

_____
AUTHORIZED SIGNATURE

_____
Printed Name and Title

_____
Date Offered

REFERENCES OF BIDDER

By signing this page, the bidder certifies that he/she meets the minimum qualifications specified in GENERAL INFORMATION.

Please also provide the requested reference information specified in GENERAL INFORMATION.

Signed:

_____
Name of Person Authorized to Sign for the Bidder

_____
Title

_____
Date

DELEGATION OF AUTHORITY

At a meeting of the Board of Directors of the _____
(Name of Corporation)

_____ duly called and held on _____
(Date)

at which a quorum was present, and acting throughout, the following vote

was duly adopted: VOTED: That _____
(Name of Individual)

the _____ of the Corporation, hereby is authorized
(Title)

to affix the Corporate Seal, sign and deliver in the name and on behalf of the Corporation, bids, proposals, contracts, bills of sale, conditional sale agreements, chattel mortgages, leases, bonds, applications, affidavits, certificates, and any other similar documents required in connection with the sale of the Corporation's products to any purchaser, including assignments and satisfactions of any such documents.

Any and all applications, affidavits, statements, certificates, and similar documents required by law in connection with the licensing of the Corporation or its representatives for the sale, distribution, and servicing of its commercial products.

The authority is hereby delegated and shall be exercised by the aforesaid person in connection with the duties as

_____ of _____
(Title) (Name of Corporation)

and not otherwise.

ATTEST: _____ DATE: _____

NOTE: This form must be completed if the contractor is a corporation.

ATTACHMENT 1

COMMONWEALTH OF MASSACHUSETTS PREVAILING WAGE RATES

The Massachusetts Prevailing Wage Law
M.G.L. ch. 149, §§ 26 - 27

NOTICE TO AWARDING AUTHORITIES

- The enclosed wage schedule applies only to the specific project listed at the top and will remain in effect for the duration of the project.

- You should request an updated wage schedule from the Division of Occupational Safety if you have not opened bids or selected a contractor within 90 days of the date of issuance of the enclosed wage schedule.

- The wage schedule shall be incorporated in any advertisement or call for bids for the project for which it has been issued.

- Once a contractor has been selected by the awarding authority, the wage schedule shall be made a part of the contract for that project.

NOTICE TO CONTRACTORS

- The enclosed wage schedule must be posted in a conspicuous place at the work site during the life of the project.

- The wages listed on the enclosed wage schedule must be paid to employees on public works projects regardless of whether they are employed by the prime contractor, a filed sub-bidder, or any sub-contractor.

- The enclosed wage schedule applies to all phases of the project including the final clean-up. Contractors whose only role is to perform final clean-up must pay their employees according to this wage schedule.

- All apprentices must be registered with the Massachusetts Division of Apprentice Training in order to be paid at the reduced apprentice rates. If a worker is not registered with the Division of Apprentice Training, they must be paid the "total rate" listed on the wage schedule regardless of experience or skill level. For further information, please call (617) 727-3486 or write to the Division of Apprentice Training, 399 Washington Street, 4th Floor, Boston, MA 02108

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

Prevailing Wage Rates

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

CHARLES D. BAKER
Governor

KARYN E. POLITO
Lt. Governor

RONALD L. WALKER, II
Secretary

HEATHER E. ROWE
Director

Awarding Authority: Town of Plymouth

Contract Number: 21515 **City/Town:** PLYMOUTH

Description of Work: Construction of approximately 5,700 linear feet of gravity sewer and appurtenances, one (1) wastewater pumping station, approximately 2,800 linear feet of force main, and associated paving

Job Location: Samoset St.

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

- This wage schedule applies only to the specific project referenced at the top of this page and uniquely identified by the "Wage Request Number" on all pages of this schedule.
- An Awarding Authority must request an updated wage schedule from the Department of Labor Standards ("DLS") if it has not opened bids or selected a contractor within 90 days of the date of issuance of the wage schedule. For CM AT RISK projects (bid pursuant to G.L. c.149A), the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work must be within 90-days of the wage schedule issuance date.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project as required by M.G.L. c. 149, § 27. The wage schedule shall be made a part of the contract awarded for the project. The wage schedule must be posted in a conspicuous place at the work site for the life of the project in accordance with M.G.L. c. 149 § 27. The wages listed on the wage schedule must be paid to employees performing construction work on the project whether they are employed by the prime contractor, a filed sub-bidder, or any sub-contractor.
- All apprentices working on the project are required to be registered with the Massachusetts Division of Apprentice Standards (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. **If an apprentice rate is not listed on the prevailing wage schedule for the trade in which an apprentice is registered with the DAS, the apprentice 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 criminal penalties.

Issue Date: 02/20/2015 **Wage Request Number:** 20150220-003

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Construction						
(2 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2014	$31.30	$9.91	$9.33	$0.00	$50.54
	06/01/2015	$31.65	$9.91	$9.33	$0.00	$50.89
	08/01/2015	$31.65	$10.41	$9.33	$0.00	$51.39
	12/01/2015	$31.65	$10.41	$10.08	$0.00	$52.14
	06/01/2016	$32.15	$10.41	$10.08	$0.00	$52.64
	08/01/2016	$32.15	$10.91	$10.08	$0.00	$53.14
	12/01/2016	$32.15	$10.91	$10.89	$0.00	$53.95
(3 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2014	$31.37	$9.91	$9.33	$0.00	$50.61
	06/01/2015	$31.72	$9.91	$9.33	$0.00	$50.96
	08/01/2015	$31.72	$10.41	$9.33	$0.00	$51.46
	12/01/2015	$31.72	$10.41	$10.08	$0.00	$52.21
	06/01/2016	$32.22	$10.41	$10.08	$0.00	$52.71
	08/01/2016	$32.22	$10.91	$10.08	$0.00	$53.21
	12/01/2016	$32.22	$10.91	$10.89	$0.00	$54.02
(4 & 5 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2014	$31.49	$9.91	$9.33	$0.00	$50.73
	06/01/2015	$31.84	$9.91	$9.33	$0.00	$51.08
	08/01/2015	$31.84	$10.41	$9.33	$0.00	$51.58
	12/01/2015	$31.84	$10.41	$10.08	$0.00	$52.33
	06/01/2016	$32.34	$10.41	$10.08	$0.00	$52.83
	08/01/2016	$32.34	$10.91	$10.08	$0.00	$53.33
	12/01/2016	$32.34	$10.91	$10.89	$0.00	$54.14
ADS/SUBMERSIBLE PILOT *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2014	$87.36	$9.80	$18.17	$0.00	$115.33
	08/01/2015	$90.51	$9.80	$18.17	$0.00	$118.48
AIR TRACK OPERATOR *LABORERS - ZONE 2*	12/01/2014	$31.40	$7.30	$12.30	$0.00	$51.00
	06/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	12/01/2015	$32.40	$7.30	$12.30	$0.00	$52.00
	06/01/2016	$32.90	$7.30	$12.30	$0.00	$52.50
	12/01/2016	$33.65	$7.30	$12.30	$0.00	$53.25
For apprentice rates see "Apprentice- LABORER"						
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	12/01/2014	$32.48	$10.40	$5.95	$0.00	$48.83
	06/01/2015	$33.43	$10.40	$5.95	$0.00	$49.78
	12/01/2015	$34.38	$10.40	$5.95	$0.00	$50.73
ASPHALT RAKER *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$42.39	$10.00	$14.30	$0.00	$66.69
	06/01/2015	$43.14	$10.00	$14.30	$0.00	$67.44
	12/01/2015	$44.39	$10.00	$14.30	$0.00	$68.69
	06/01/2016	$45.14	$10.00	$14.30	$0.00	$69.44
	12/01/2016	$46.39	$10.00	$14.30	$0.00	$70.69
	06/01/2017	$47.39	$10.00	$14.30	$0.00	$71.69
	12/01/2017	$48.39	$10.00	$14.30	$0.00	$72.69

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BACKHOE/FRONT-END LOADER *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$42.39	$10.00	$14.30	$0.00	$66.69
	06/01/2015	$43.14	$10.00	$14.30	$0.00	$67.44
	12/01/2015	$44.39	$10.00	$14.30	$0.00	$68.69
	06/01/2016	$45.14	$10.00	$14.30	$0.00	$69.44
	12/01/2016	$46.39	$10.00	$14.30	$0.00	$70.69
	06/01/2017	$47.39	$10.00	$14.30	$0.00	$71.69
	12/01/2017	$48.39	$10.00	$14.30	$0.00	$72.69
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER *LABORERS - ZONE 2*	12/01/2014	$31.40	$7.30	$12.30	$0.00	$51.00
	06/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	12/01/2015	$32.40	$7.30	$12.30	$0.00	$52.00
	06/01/2016	$32.90	$7.30	$12.30	$0.00	$52.50
	12/01/2016	$33.65	$7.30	$12.30	$0.00	$53.25
For apprentice rates see "Apprentice- LABORER"						
BOILER MAKER *BOILERMAKERS LOCAL 29*	01/01/2010	$37.70	$6.97	$11.18	$0.00	$55.85

Apprentice - *BOILERMAKER - Local 29*

Effective Date - 01/01/2010

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

Notes:

Apprentice to Journeyworker Ratio:1:5

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) *BRICKLAYERS LOCAL 3 (QUINCY)*	02/01/2015	$48.96	$10.18	$18.50	$0.00	$77.64
	08/01/2015	$49.86	$10.18	$18.57	$0.00	$78.61
	02/01/2016	$50.43	$10.18	$18.57	$0.00	$79.18
	08/01/2016	$51.33	$10.18	$18.65	$0.00	$80.16
	02/01/2017	$51.90	$10.18	$18.65	$0.00	$80.73

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 02/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.48	$10.18	$18.50	$0.00	$53.16
2	60	$29.38	$10.18	$18.50	$0.00	$58.06
3	70	$34.27	$10.18	$18.50	$0.00	$62.95
4	80	$39.17	$10.18	$18.50	$0.00	$67.85
5	90	$44.06	$10.18	$18.50	$0.00	$72.74

Effective Date - 08/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.93	$10.18	$18.57	$0.00	$53.68
2	60	$29.92	$10.18	$18.57	$0.00	$58.67
3	70	$34.90	$10.18	$18.57	$0.00	$63.65
4	80	$39.89	$10.18	$18.57	$0.00	$68.64
5	90	$44.87	$10.18	$18.57	$0.00	$73.62

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$41.99	$10.00	$14.30	$0.00	$66.29
	06/01/2015	$42.73	$10.00	$14.30	$0.00	$67.03
	12/01/2015	$43.97	$10.00	$14.30	$0.00	$68.27
	06/01/2016	$44.72	$10.00	$14.30	$0.00	$69.02
	12/01/2016	$45.95	$10.00	$14.30	$0.00	$70.25
	06/01/2017	$46.94	$10.00	$14.30	$0.00	$71.24
	12/01/2017	$47.93	$10.00	$14.30	$0.00	$72.23
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
CAISSON & UNDERPINNING BOTTOM MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2014	$35.70	$7.30	$13.15	$0.00	$56.15
	06/01/2015	$36.45	$7.30	$13.15	$0.00	$56.90
	12/01/2015	$37.20	$7.30	$13.15	$0.00	$57.65
	06/01/2016	$37.95	$7.30	$13.15	$0.00	$58.40
	12/01/2016	$38.95	$7.30	$13.15	$0.00	$59.40
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2014	$34.55	$7.30	$13.15	$0.00	$55.00
	06/01/2015	$35.30	$7.30	$13.15	$0.00	$55.75
	12/01/2015	$36.05	$7.30	$13.15	$0.00	$56.50
	06/01/2016	$36.80	$7.30	$13.15	$0.00	$57.25
	12/01/2016	$37.80	$7.30	$13.15	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CAISSON & UNDERPINNING TOP MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2014	$34.55	$7.30	$13.15	$0.00	$55.00
	06/01/2015	$35.30	$7.30	$13.15	$0.00	$55.75
	12/01/2015	$36.05	$7.30	$13.15	$0.00	$56.50
	06/01/2016	$36.80	$7.30	$13.15	$0.00	$57.25
	12/01/2016	$37.80	$7.30	$13.15	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						
CARBIDE CORE DRILL OPERATOR *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
CARPENTER *CARPENTERS -ZONE 2 (Eastern Massachusetts)*	09/01/2014	$35.35	$9.80	$16.11	$0.00	$61.26
	03/01/2015	$36.12	$9.80	$16.11	$0.00	$62.03

Apprentice - *CARPENTER - Zone 2 Eastern MA*

Effective Date - 09/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.68	$9.80	$1.57	$0.00	$29.05
2	60	$21.21	$9.80	$1.57	$0.00	$32.58
3	70	$24.75	$9.80	$11.40	$0.00	$45.95
4	75	$26.51	$9.80	$11.40	$0.00	$47.71
5	80	$28.28	$9.80	$12.97	$0.00	$51.05
6	80	$28.28	$9.80	$12.97	$0.00	$51.05
7	90	$31.82	$9.80	$14.54	$0.00	$56.16
8	90	$31.82	$9.80	$14.54	$0.00	$56.16

Effective Date - 03/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.06	$9.80	$1.57	$0.00	$29.43
2	60	$21.67	$9.80	$1.57	$0.00	$33.04
3	70	$25.28	$9.80	$11.40	$0.00	$46.48
4	75	$27.09	$9.80	$11.40	$0.00	$48.29
5	80	$28.90	$9.80	$12.97	$0.00	$51.67
6	80	$28.90	$9.80	$12.97	$0.00	$51.67
7	90	$32.51	$9.80	$14.54	$0.00	$56.85
8	90	$32.51	$9.80	$14.54	$0.00	$56.85

Notes:

Apprentice to Journeyworker Ratio:1:5

CEMENT MASONRY/PLASTERING *BRICKLAYERS LOCAL 3 (QUINCY)*	01/01/2015	$44.90	$10.90	$18.71	$1.30	$75.81
	07/01/2015	$45.82	$10.90	$18.71	$1.30	$76.73
	01/01/2016	$46.44	$10.90	$18.71	$1.30	$77.35

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 01/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.45	$10.90	$12.21	$1.30	$46.86
2	60	$26.94	$10.90	$13.71	$1.30	$52.85
3	65	$29.19	$10.90	$14.71	$1.30	$56.10
4	70	$31.43	$10.90	$15.71	$1.30	$59.34
5	75	$33.68	$10.90	$16.71	$1.30	$62.59
6	80	$35.92	$10.90	$17.71	$1.30	$65.83
7	90	$40.41	$10.90	$18.71	$1.30	$71.32

Effective Date - 07/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.91	$10.90	$12.21	$1.30	$47.32
2	60	$27.49	$10.90	$13.71	$1.30	$53.40
3	65	$29.78	$10.90	$14.71	$1.30	$56.69
4	70	$32.07	$10.90	$15.71	$1.30	$59.98
5	75	$34.37	$10.90	$16.71	$1.30	$63.28
6	80	$36.66	$10.90	$17.71	$1.30	$66.57
7	90	$41.24	$10.90	$18.71	$1.30	$72.15

Notes:

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

Apprentice to Journeyworker Ratio:1:3

CHAIN SAW OPERATOR *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75

For apprentice rates see "Apprentice- LABORER"

CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$43.39	$10.00	$14.30	$0.00	$67.69
	06/01/2015	$44.14	$10.00	$14.30	$0.00	$68.44
	12/01/2015	$45.39	$10.00	$14.30	$0.00	$69.69
	06/01/2016	$46.14	$10.00	$14.30	$0.00	$70.44
	12/01/2016	$47.39	$10.00	$14.30	$0.00	$71.69
	06/01/2017	$48.39	$10.00	$14.30	$0.00	$72.69
	12/01/2017	$49.39	$10.00	$14.30	$0.00	$73.69

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
COMPRESSOR OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$29.40	$10.00	$14.30	$0.00	$53.70
	06/01/2015	$29.92	$10.00	$14.30	$0.00	$54.22
	12/01/2015	$30.79	$10.00	$14.30	$0.00	$55.09
	06/01/2016	$31.31	$10.00	$14.30	$0.00	$55.61
	12/01/2016	$32.18	$10.00	$14.30	$0.00	$56.48
	06/01/2017	$32.87	$10.00	$14.30	$0.00	$57.17
	12/01/2017	$33.56	$10.00	$14.30	$0.00	$57.86
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DELEADER (BRIDGE) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2015	$47.66	$7.85	$16.10	$0.00	$71.61
	07/01/2015	$48.56	$7.85	$16.10	$0.00	$72.51
	01/01/2016	$49.51	$7.85	$16.10	$0.00	$73.46
	07/01/2016	$50.46	$7.85	$16.10	$0.00	$74.41
	01/01/2017	$51.41	$7.85	$16.10	$0.00	$75.36

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.83	$7.85	$0.00	$0.00	$31.68
2	55	$26.21	$7.85	$3.66	$0.00	$37.72
3	60	$28.60	$7.85	$3.99	$0.00	$40.44
4	65	$30.98	$7.85	$4.32	$0.00	$43.15
5	70	$33.36	$7.85	$14.11	$0.00	$55.32
6	75	$35.75	$7.85	$14.44	$0.00	$58.04
7	80	$38.13	$7.85	$14.77	$0.00	$60.75
8	90	$42.89	$7.85	$15.44	$0.00	$66.18

Effective Date - 07/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.28	$7.85	$0.00	$0.00	$32.13
2	55	$26.71	$7.85	$3.66	$0.00	$38.22
3	60	$29.14	$7.85	$3.99	$0.00	$40.98
4	65	$31.56	$7.85	$4.32	$0.00	$43.73
5	70	$33.99	$7.85	$14.11	$0.00	$55.95
6	75	$36.42	$7.85	$14.44	$0.00	$58.71
7	80	$38.85	$7.85	$14.77	$0.00	$61.47
8	90	$43.70	$7.85	$15.44	$0.00	$66.99

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN *LABORERS - ZONE 2*	12/01/2014	$34.75	$7.30	$12.95	$0.00	$55.00
	06/01/2015	$35.50	$7.30	$12.95	$0.00	$55.75
	12/01/2015	$36.25	$7.30	$12.95	$0.00	$56.50
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: BACKHOE/LOADER/HAMMER OPERATOR *LABORERS - ZONE 2*	12/01/2014	$35.75	$7.30	$12.95	$0.00	$56.00
	06/01/2015	$36.50	$7.30	$12.95	$0.00	$56.75
	12/01/2015	$37.25	$7.30	$12.95	$0.00	$57.50
For apprentice rates see "Apprentice- LABORER"						
DEMO: BURNERS *LABORERS - ZONE 2*	12/01/2014	$35.50	$7.30	$12.95	$0.00	$55.75
	06/01/2015	$36.25	$7.30	$12.95	$0.00	$56.50
	12/01/2015	$37.00	$7.30	$12.95	$0.00	$57.25
For apprentice rates see "Apprentice- LABORER"						
DEMO: CONCRETE CUTTER/SAWYER *LABORERS - ZONE 2*	12/01/2014	$35.75	$7.30	$12.95	$0.00	$56.00
	06/01/2015	$36.50	$7.30	$12.95	$0.00	$56.75
	12/01/2015	$37.25	$7.30	$12.95	$0.00	$57.50
For apprentice rates see "Apprentice- LABORER"						
DEMO: JACKHAMMER OPERATOR *LABORERS - ZONE 2*	12/01/2014	$35.50	$7.30	$12.95	$0.00	$55.75
	06/01/2015	$36.25	$7.30	$12.95	$0.00	$56.50
	12/01/2015	$37.00	$7.30	$12.95	$0.00	$57.25
For apprentice rates see "Apprentice- LABORER"						
DEMO: WRECKING LABORER *LABORERS - ZONE 2*	12/01/2014	$34.75	$7.30	$12.95	$0.00	$55.00
	06/01/2015	$35.50	$7.30	$12.95	$0.00	$55.75
	12/01/2015	$36.25	$7.30	$12.95	$0.00	$56.50
For apprentice rates see "Apprentice- LABORER"						
DIRECTIONAL DRILL MACHINE OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$41.99	$10.00	$14.30	$0.00	$66.29
	06/01/2015	$42.73	$10.00	$14.30	$0.00	$67.03
	12/01/2015	$43.97	$10.00	$14.30	$0.00	$68.27
	06/01/2016	$44.72	$10.00	$14.30	$0.00	$69.02
	12/01/2016	$45.95	$10.00	$14.30	$0.00	$70.25
	06/01/2017	$46.94	$10.00	$14.30	$0.00	$71.24
	12/01/2017	$47.93	$10.00	$14.30	$0.00	$72.23
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2014	$58.24	$9.80	$18.17	$0.00	$86.21
	08/01/2015	$60.34	$9.80	$18.17	$0.00	$88.31
DIVER TENDER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2014	$41.60	$9.80	$18.17	$0.00	$69.57
	08/01/2015	$43.10	$9.80	$18.17	$0.00	$71.07
DIVER TENDER (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2014	$62.40	$9.80	$18.17	$0.00	$90.37
	08/01/2015	$64.65	$9.80	$18.17	$0.00	$92.62
DIVER/SLURRY (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2014	$87.36	$9.80	$18.17	$0.00	$115.33
	08/01/2015	$90.51	$9.80	$18.17	$0.00	$118.48
ELECTRICIAN *ELECTRICIANS LOCAL 223*	09/01/2014	$37.31	$8.00	$11.03	$0.00	$56.34
	09/01/2015	$38.31	$8.40	$11.28	$0.00	$57.99
	09/01/2016	$39.21	$8.90	$11.51	$0.00	$59.62

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELECTRICIAN - Local 223*

Effective Date - 09/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$14.92	$0.00	$0.45	$0.00	$15.37
2	42	$15.67	$0.00	$0.47	$0.00	$16.14
3	45	$16.79	$8.00	$0.50	$0.00	$25.29
4	48	$17.91	$8.00	$3.30	$0.00	$29.21
5	50	$18.66	$8.00	$3.41	$0.00	$30.07
6	55	$20.52	$8.00	$3.68	$0.00	$32.20
7	60	$22.39	$8.00	$3.94	$0.00	$34.33
8	65	$24.25	$8.00	$4.22	$0.00	$36.47
9	70	$26.12	$8.00	$4.48	$0.00	$38.60
10	75	$27.98	$8.00	$4.76	$0.00	$40.74

Effective Date - 09/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$15.32	$0.00	$0.46	$0.00	$15.78
2	42	$16.09	$0.00	$0.48	$0.00	$16.57
3	45	$17.24	$8.40	$0.52	$0.00	$26.16
4	48	$18.39	$8.40	$3.36	$0.00	$30.15
5	50	$19.16	$8.40	$3.47	$0.00	$31.03
6	55	$21.07	$8.40	$3.75	$0.00	$33.22
7	60	$22.99	$8.40	$4.03	$0.00	$35.42
8	65	$24.90	$8.40	$4.31	$0.00	$37.61
9	70	$26.82	$8.40	$5.28	$0.00	$40.50
10	75	$28.73	$8.40	$4.86	$0.00	$41.99

Notes:

Steps are 750 hours

Apprentice to Journeyworker Ratio:2:3***

ELEVATOR CONSTRUCTOR *ELEVATOR CONSTRUCTORS LOCAL 4*	01/01/2012	$52.45	$8.78	$6.96	$0.00	$68.19

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELEVATOR CONSTRUCTOR - Local 4*

Effective Date - 01/01/2012

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

Notes:

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

Apprentice to Journeyworker Ratio:1:1

ELEVATOR CONSTRUCTOR HELPER *ELEVATOR CONSTRUCTORS LOCAL 4*	01/01/2012	$38.59	$8.78	$6.96	$0.00	$54.33

For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"

FENCE & GUARD RAIL ERECTOR *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75

For apprentice rates see "Apprentice- LABORER"

FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2014	$39.59	$10.00	$14.18	$0.00	$63.77
	05/01/2015	$40.32	$10.00	$14.18	$0.00	$64.50
	11/01/2015	$40.90	$10.00	$14.18	$0.00	$65.08
	05/01/2016	$41.79	$10.00	$14.18	$0.00	$65.97
	11/01/2016	$42.38	$10.00	$14.18	$0.00	$66.56
	05/01/2017	$43.26	$10.00	$14.18	$0.00	$67.44
	11/01/2017	$43.99	$10.00	$14.18	$0.00	$68.17
	05/01/2018	$44.70	$10.00	$14.18	$0.00	$68.88

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2014	$41.02	$10.00	$14.18	$0.00	$65.20
	05/01/2015	$41.75	$10.00	$14.18	$0.00	$65.93
	11/01/2015	$42.34	$10.00	$14.18	$0.00	$66.52
	05/01/2016	$43.23	$10.00	$14.18	$0.00	$67.41
	11/01/2016	$43.83	$10.00	$14.18	$0.00	$68.01
	05/01/2017	$44.72	$10.00	$14.18	$0.00	$68.90
	11/01/2017	$45.45	$10.00	$14.18	$0.00	$69.63
	05/01/2018	$46.17	$10.00	$14.18	$0.00	$70.35

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2014	$21.35	$10.00	$14.18	$0.00	$45.53
	05/01/2015	$21.78	$10.00	$14.18	$0.00	$45.96
	11/01/2015	$22.12	$10.00	$14.18	$0.00	$46.30
	05/01/2016	$22.64	$10.00	$14.18	$0.00	$46.82
	11/01/2016	$22.99	$10.00	$14.18	$0.00	$47.17
	05/01/2017	$23.52	$10.00	$14.18	$0.00	$47.70
	11/01/2017	$23.94	$10.00	$14.18	$0.00	$48.12
	05/01/2018	$24.37	$10.00	$14.18	$0.00	$48.55
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIRE ALARM INSTALLER *ELECTRICIANS LOCAL 223*	09/01/2014	$37.31	$8.00	$11.03	$0.00	$56.34
	09/01/2015	$38.31	$8.40	$11.28	$0.00	$57.99
	09/01/2016	$39.21	$8.90	$11.51	$0.00	$59.62
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINTENANCE / COMMISSIONING*ELECTRICIANS LOCAL 223*	09/01/2014	$31.71	$8.00	$9.38	$0.00	$49.09
	09/01/2015	$32.56	$8.40	$9.59	$0.00	$50.55
	09/01/2016	$33.33	$8.90	$9.78	$0.00	$52.01
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"						
FIREMAN (ASST. ENGINEER) *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$35.33	$10.00	$14.30	$0.00	$59.63
	06/01/2015	$35.95	$10.00	$14.30	$0.00	$60.25
	12/01/2015	$37.00	$10.00	$14.30	$0.00	$61.30
	06/01/2016	$37.62	$10.00	$14.30	$0.00	$61.92
	12/01/2016	$38.66	$10.00	$14.30	$0.00	$62.96
	06/01/2017	$39.50	$10.00	$14.30	$0.00	$63.80
	12/01/2017	$40.33	$10.00	$14.30	$0.00	$64.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER *LABORERS - ZONE 2*	12/01/2014	$20.50	$7.30	$12.30	$0.00	$40.10
	06/01/2015	$20.50	$7.30	$12.30	$0.00	$40.10
	12/01/2015	$20.50	$7.30	$12.30	$0.00	$40.10
	06/01/2016	$20.50	$7.30	$12.30	$0.00	$40.10
	12/01/2016	$20.50	$7.30	$12.30	$0.00	$40.10
For apprentice rates see "Apprentice- LABORER"						
FLOORCOVERER *FLOORCOVERERS LOCAL 2168 ZONE I*	09/01/2014	$40.40	$9.80	$17.21	$0.00	$67.41

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *FLOORCOVERER - Local 2168 Zone I*

Effective Date - 09/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.20	$9.80	$1.79	$0.00	$31.79
2	55	$22.22	$9.80	$1.79	$0.00	$33.81
3	60	$24.24	$9.80	$11.84	$0.00	$45.88
4	65	$26.26	$9.80	$11.84	$0.00	$47.90
5	70	$28.28	$9.80	$13.63	$0.00	$51.71
6	75	$30.30	$9.80	$13.63	$0.00	$53.73
7	80	$32.32	$9.80	$15.42	$0.00	$57.54
8	85	$34.34	$9.80	$15.42	$0.00	$59.56

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

FORK LIFT/CHERRY PICKER *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$42.39	$10.00	$14.30	$0.00	$66.69
	06/01/2015	$43.14	$10.00	$14.30	$0.00	$67.44
	12/01/2015	$44.39	$10.00	$14.30	$0.00	$68.69
	06/01/2016	$45.14	$10.00	$14.30	$0.00	$69.44
	12/01/2016	$46.39	$10.00	$14.30	$0.00	$70.69
	06/01/2017	$47.39	$10.00	$14.30	$0.00	$71.69
	12/01/2017	$48.39	$10.00	$14.30	$0.00	$72.69
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GENERATOR/LIGHTING PLANT/HEATERS *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$29.40	$10.00	$14.30	$0.00	$53.70
	06/01/2015	$29.92	$10.00	$14.30	$0.00	$54.22
	12/01/2015	$30.79	$10.00	$14.30	$0.00	$55.09
	06/01/2016	$31.31	$10.00	$14.30	$0.00	$55.61
	12/01/2016	$32.18	$10.00	$14.30	$0.00	$56.48
	06/01/2017	$32.87	$10.00	$14.30	$0.00	$57.17
	12/01/2017	$33.56	$10.00	$14.30	$0.00	$57.86
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) *GLAZIERS LOCAL 35 (ZONE 2)*	01/01/2015	$37.16	$7.85	$16.10	$0.00	$61.11
	07/01/2015	$38.06	$7.85	$16.10	$0.00	$62.01
	01/01/2016	$39.01	$7.85	$16.10	$0.00	$62.96
	07/01/2016	$39.96	$7.85	$16.10	$0.00	$63.91
	01/01/2017	$40.91	$7.85	$16.10	$0.00	$64.86

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *GLAZIER - Local 35 Zone 2*

Effective Date - 01/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.58	$7.85	$0.00	$0.00	$26.43
2	55	$20.44	$7.85	$3.66	$0.00	$31.95
3	60	$22.30	$7.85	$3.99	$0.00	$34.14
4	65	$24.15	$7.85	$4.32	$0.00	$36.32
5	70	$26.01	$7.85	$14.11	$0.00	$47.97
6	75	$27.87	$7.85	$14.44	$0.00	$50.16
7	80	$29.73	$7.85	$14.77	$0.00	$52.35
8	90	$33.44	$7.85	$15.44	$0.00	$56.73

Effective Date - 07/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.03	$7.85	$0.00	$0.00	$26.88
2	55	$20.93	$7.85	$3.66	$0.00	$32.44
3	60	$22.84	$7.85	$3.99	$0.00	$34.68
4	65	$24.74	$7.85	$4.32	$0.00	$36.91
5	70	$26.64	$7.85	$14.11	$0.00	$48.60
6	75	$28.55	$7.85	$14.44	$0.00	$50.84
7	80	$30.45	$7.85	$14.77	$0.00	$53.07
8	90	$34.25	$7.85	$15.44	$0.00	$57.54

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

HOISTING ENGINEER/CRANES/GRADALLS *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$42.39	$10.00	$14.30	$0.00	$66.69
	06/01/2015	$43.14	$10.00	$14.30	$0.00	$67.44
	12/01/2015	$44.39	$10.00	$14.30	$0.00	$68.69
	06/01/2016	$45.14	$10.00	$14.30	$0.00	$69.44
	12/01/2016	$46.39	$10.00	$14.30	$0.00	$70.69
	06/01/2017	$47.39	$10.00	$14.30	$0.00	$71.69
	12/01/2017	$48.39	$10.00	$14.30	$0.00	$72.69

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *OPERATING ENGINEERS - Local 4*

Effective Date - 12/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$23.31	$10.00	$0.00	$0.00	$33.31
2	60	$25.43	$10.00	$14.30	$0.00	$49.73
3	65	$27.55	$10.00	$14.30	$0.00	$51.85
4	70	$29.67	$10.00	$14.30	$0.00	$53.97
5	75	$31.79	$10.00	$14.30	$0.00	$56.09
6	80	$33.91	$10.00	$14.30	$0.00	$58.21
7	85	$36.03	$10.00	$14.30	$0.00	$60.33
8	90	$38.15	$10.00	$14.30	$0.00	$62.45

Effective Date - 06/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$23.73	$10.00	$0.00	$0.00	$33.73
2	60	$25.88	$10.00	$14.30	$0.00	$50.18
3	65	$28.04	$10.00	$14.30	$0.00	$52.34
4	70	$30.20	$10.00	$14.30	$0.00	$54.50
5	75	$32.36	$10.00	$14.30	$0.00	$56.66
6	80	$34.51	$10.00	$14.30	$0.00	$58.81
7	85	$36.67	$10.00	$14.30	$0.00	$60.97
8	90	$38.83	$10.00	$14.30	$0.00	$63.13

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2015	$43.69	$9.82	$20.54	$2.19	$76.24
	08/01/2015	$44.69	$9.82	$20.54	$2.19	$77.24
	02/01/2016	$45.69	$9.82	$20.54	$2.19	$78.24
	08/01/2016	$46.84	$9.82	$20.54	$2.19	$79.39
	02/01/2017	$47.94	$9.82	$20.54	$2.19	$80.49
	08/01/2017	$49.04	$9.82	$20.54	$2.19	$81.59
	02/01/2018	$50.19	$9.82	$20.54	$2.19	$82.74

For apprentice rates see "Apprentice- SHEET METAL WORKER"

HVAC (ELECTRICAL CONTROLS) *ELECTRICIANS LOCAL 223*	09/01/2014	$37.31	$8.00	$11.03	$0.00	$56.34
	09/01/2015	$38.31	$8.40	$11.28	$0.00	$57.99
	09/01/2016	$39.21	$8.90	$11.51	$0.00	$59.62

For apprentice rates see "Apprentice- ELECTRICIAN"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HVAC (TESTING AND BALANCING - AIR) *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2015	$43.69	$9.82	$20.54	$2.19	$76.24
	08/01/2015	$44.69	$9.82	$20.54	$2.19	$77.24
	02/01/2016	$45.69	$9.82	$20.54	$2.19	$78.24
	08/01/2016	$46.84	$9.82	$20.54	$2.19	$79.39
	02/01/2017	$47.94	$9.82	$20.54	$2.19	$80.49
	08/01/2017	$49.04	$9.82	$20.54	$2.19	$81.59
	02/01/2018	$50.19	$9.82	$20.54	$2.19	$82.74
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (TESTING AND BALANCING -WATER) *PLUMBERS & PIPEFITTERS LOCAL 51*	09/01/2014	$35.88	$11.00	$15.35	$0.00	$62.23
	03/01/2015	$36.63	$11.00	$15.35	$0.00	$62.98
	09/01/2015	$37.38	$11.00	$15.35	$0.00	$63.73
	03/01/2016	$38.13	$11.00	$15.35	$0.00	$64.48
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HVAC MECHANIC *PLUMBERS & PIPEFITTERS LOCAL 51*	09/01/2014	$35.88	$11.00	$15.35	$0.00	$62.23
	03/01/2015	$36.63	$11.00	$15.35	$0.00	$62.98
	09/01/2015	$37.38	$11.00	$15.35	$0.00	$63.73
	03/01/2016	$38.13	$11.00	$15.35	$0.00	$64.48
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HYDRAULIC DRILLS *LABORERS - ZONE 2*	12/01/2014	$31.40	$7.30	$12.30	$0.00	$51.00
	06/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	12/01/2015	$32.40	$7.30	$12.30	$0.00	$52.00
	06/01/2016	$32.90	$7.30	$12.30	$0.00	$52.50
	12/01/2016	$33.65	$7.30	$12.30	$0.00	$53.25
For apprentice rates see "Apprentice- LABORER"						
INSULATOR (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	09/01/2014	$43.31	$11.25	$12.60	$0.00	$67.16

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

Effective Date - 09/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.66	$11.25	$9.35	$0.00	$42.26
2	60	$25.99	$11.25	$10.00	$0.00	$47.24
3	70	$30.32	$11.25	$10.65	$0.00	$52.22
4	80	$34.65	$11.25	$11.30	$0.00	$57.20

Notes:

Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER *IRONWORKERS LOCAL 7 (BOSTON AREA)*	03/16/2014	$41.19	$7.70	$19.25	$0.00	$68.14

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *IRONWORKER - Local 7 Boston*

Effective Date - 03/16/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$24.71	$7.70	$19.25	$0.00	$51.66
2	70	$28.83	$7.70	$19.25	$0.00	$55.78
3	75	$30.89	$7.70	$19.25	$0.00	$57.84
4	80	$32.95	$7.70	$19.25	$0.00	$59.90
5	85	$35.01	$7.70	$19.25	$0.00	$61.96
6	90	$37.07	$7.70	$19.25	$0.00	$64.02

Notes:

** Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:**

JACKHAMMER & PAVING BREAKER OPERATOR *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75

For apprentice rates see "Apprentice- LABORER"

LABORER *LABORERS - ZONE 2*	12/01/2014	$30.65	$7.30	$12.30	$0.00	$50.25
	06/01/2015	$31.15	$7.30	$12.30	$0.00	$50.75
	12/01/2015	$31.65	$7.30	$12.30	$0.00	$51.25
	06/01/2016	$32.15	$7.30	$12.30	$0.00	$51.75
	12/01/2016	$32.90	$7.30	$12.30	$0.00	$52.50

Apprentice - *LABORER - Zone 2*

Effective Date - 12/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$18.39	$7.30	$12.30	$0.00	$37.99
2	70	$21.46	$7.30	$12.30	$0.00	$41.06
3	80	$24.52	$7.30	$12.30	$0.00	$44.12
4	90	$27.59	$7.30	$12.30	$0.00	$47.19

Effective Date - 06/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$18.69	$7.30	$12.30	$0.00	$38.29
2	70	$21.81	$7.30	$12.30	$0.00	$41.41
3	80	$24.92	$7.30	$12.30	$0.00	$44.52
4	90	$28.04	$7.30	$12.30	$0.00	$47.64

Notes:

Apprentice to Journeyworker Ratio:1:5

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: CARPENTER TENDER *LABORERS - ZONE 2*	12/01/2014	$30.65	$7.30	$12.30	$0.00	$50.25
	06/01/2015	$31.15	$7.30	$12.30	$0.00	$50.75
	12/01/2015	$31.65	$7.30	$12.30	$0.00	$51.25
	06/01/2016	$32.15	$7.30	$12.30	$0.00	$51.75
	12/01/2016	$32.90	$7.30	$12.30	$0.00	$52.50
For apprentice rates see "Apprentice- LABORER"						
LABORER: CEMENT FINISHER TENDER *LABORERS - ZONE 2*	12/01/2014	$30.65	$7.30	$12.30	$0.00	$50.25
	06/01/2015	$31.15	$7.30	$12.30	$0.00	$50.75
	12/01/2015	$31.65	$7.30	$12.30	$0.00	$51.25
	06/01/2016	$32.15	$7.30	$12.30	$0.00	$51.75
	12/01/2016	$32.90	$7.30	$12.30	$0.00	$52.50
For apprentice rates see "Apprentice- LABORER"						
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER *LABORERS - ZONE 2*	12/01/2014	$30.85	$7.30	$12.25	$0.00	$50.40
	06/01/2015	$31.35	$7.30	$12.25	$0.00	$50.90
	12/01/2015	$31.85	$7.30	$12.25	$0.00	$51.40
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
LABORER: MULTI-TRADE TENDER *LABORERS - ZONE 2*	12/01/2014	$30.65	$7.30	$12.30	$0.00	$50.25
	06/01/2015	$31.15	$7.30	$12.30	$0.00	$50.75
	12/01/2015	$31.65	$7.30	$12.30	$0.00	$51.25
	06/01/2016	$32.15	$7.30	$12.30	$0.00	$51.75
	12/01/2016	$32.90	$7.30	$12.30	$0.00	$52.50
For apprentice rates see "Apprentice- LABORER"						
LABORER: TREE REMOVER *LABORERS - ZONE 2*	12/01/2014	$30.65	$7.30	$12.30	$0.00	$50.25
	06/01/2015	$31.15	$7.30	$12.30	$0.00	$50.75
	12/01/2015	$31.65	$7.30	$12.30	$0.00	$51.25
	06/01/2016	$32.15	$7.30	$12.30	$0.00	$51.75
	12/01/2016	$32.90	$7.30	$12.30	$0.00	$52.50
This classification applies to all tree work associated with the removal of standing trees, and trimming and removal of branches and limbs when the work is not done for a utility company for the purpose of operation, maintenance or repair of utility company equipment. For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
MARBLE & TILE FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2015	$37.37	$10.18	$17.18	$0.00	$64.73
	08/01/2015	$38.08	$10.18	$17.25	$0.00	$65.51
	02/01/2016	$38.53	$10.18	$17.25	$0.00	$65.96
	08/01/2016	$39.23	$10.18	$17.33	$0.00	$66.74
	02/01/2017	$39.69	$10.18	$17.33	$0.00	$67.20

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 02/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.69	$10.18	$17.18	$0.00	$46.05
2	60	$22.42	$10.18	$17.18	$0.00	$49.78
3	70	$26.16	$10.18	$17.18	$0.00	$53.52
4	80	$29.90	$10.18	$17.18	$0.00	$57.26
5	90	$33.63	$10.18	$17.18	$0.00	$60.99

Effective Date - 08/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.04	$10.18	$17.25	$0.00	$46.47
2	60	$22.85	$10.18	$17.25	$0.00	$50.28
3	70	$26.66	$10.18	$17.25	$0.00	$54.09
4	80	$30.46	$10.18	$17.25	$0.00	$57.89
5	90	$34.27	$10.18	$17.25	$0.00	$61.70

Notes:

Apprentice to Journeyworker Ratio:1:3

MARBLE MASONS,TILELAYERS & TERRAZZO MECH *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2015	$49.00	$10.18	$18.50	$0.00	$77.68
	08/01/2015	$49.90	$10.18	$18.57	$0.00	$78.65
	02/01/2016	$50.47	$10.18	$18.57	$0.00	$79.22
	08/01/2016	$51.37	$10.18	$18.65	$0.00	$80.20
	02/01/2017	$51.94	$10.18	$18.65	$0.00	$80.77

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 02/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.50	$10.18	$18.50	$0.00	$53.18
2	60	$29.40	$10.18	$18.50	$0.00	$58.08
3	70	$34.30	$10.18	$18.50	$0.00	$62.98
4	80	$39.20	$10.18	$18.50	$0.00	$67.88
5	90	$44.10	$10.18	$18.50	$0.00	$72.78

Effective Date - 08/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.95	$10.18	$18.57	$0.00	$53.70
2	60	$29.94	$10.18	$18.57	$0.00	$58.69
3	70	$34.93	$10.18	$18.57	$0.00	$63.68
4	80	$39.92	$10.18	$18.57	$0.00	$68.67
5	90	$44.91	$10.18	$18.57	$0.00	$73.66

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$41.99	$10.00	$14.30	$0.00	$66.29
	06/01/2015	$42.73	$10.00	$14.30	$0.00	$67.03
	12/01/2015	$43.97	$10.00	$14.30	$0.00	$68.27
	06/01/2016	$44.72	$10.00	$14.30	$0.00	$69.02
	12/01/2016	$45.95	$10.00	$14.30	$0.00	$70.25
	06/01/2017	$46.94	$10.00	$14.30	$0.00	$71.24
	12/01/2017	$47.93	$10.00	$14.30	$0.00	$72.23
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MECHANICS MAINTENANCE *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$41.99	$10.00	$14.30	$0.00	$66.29
	06/01/2015	$42.73	$10.00	$14.30	$0.00	$67.03
	12/01/2015	$43.97	$10.00	$14.30	$0.00	$68.27
	06/01/2016	$44.72	$10.00	$14.30	$0.00	$69.02
	12/01/2016	$45.95	$10.00	$14.30	$0.00	$70.25
	06/01/2017	$46.94	$10.00	$14.30	$0.00	$71.24
	12/01/2017	$47.93	$10.00	$14.30	$0.00	$72.23
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MILLWRIGHT (Zone 2) *MILLWRIGHTS LOCAL 1121 - Zone 2*	10/01/2014	$33.92	$9.80	$16.21	$0.00	$59.93
	04/01/2015	$34.69	$9.80	$16.21	$0.00	$60.70

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MILLWRIGHT - Local 1121 Zone 2*

Effective Date - 10/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$18.66	$9.80	$4.48	$0.00	$32.94
2	65	$22.05	$9.80	$13.36	$0.00	$45.21
3	75	$25.44	$9.80	$14.18	$0.00	$49.42
4	85	$28.83	$9.80	$14.99	$0.00	$53.62

Effective Date - 04/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$19.08	$9.80	$4.48	$0.00	$33.36
2	65	$22.55	$9.80	$13.36	$0.00	$45.71
3	75	$26.02	$9.80	$14.18	$0.00	$50.00
4	85	$29.49	$9.80	$14.99	$0.00	$54.28

Notes:

Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:5

MORTAR MIXER *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
OILER (OTHER THAN TRUCK CRANES,GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$21.90	$10.00	$14.30	$0.00	$46.20
	06/01/2015	$22.28	$10.00	$14.30	$0.00	$46.58
	12/01/2015	$22.93	$10.00	$14.30	$0.00	$47.23
	06/01/2016	$23.32	$10.00	$14.30	$0.00	$47.62
	12/01/2016	$23.97	$10.00	$14.30	$0.00	$48.27
	06/01/2017	$24.48	$10.00	$14.30	$0.00	$48.78
	12/01/2017	$25.00	$10.00	$14.30	$0.00	$49.30
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OILER (TRUCK CRANES, GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$25.54	$10.00	$14.30	$0.00	$49.84
	06/01/2015	$25.99	$10.00	$14.30	$0.00	$50.29
	12/01/2015	$26.74	$10.00	$14.30	$0.00	$51.04
	06/01/2016	$27.20	$10.00	$14.30	$0.00	$51.50
	12/01/2016	$27.95	$10.00	$14.30	$0.00	$52.25
	06/01/2017	$28.55	$10.00	$14.30	$0.00	$52.85
	12/01/2017	$29.16	$10.00	$14.30	$0.00	$53.46
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
OTHER POWER DRIVEN EQUIPMENT - CLASS II *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$41.99	$10.00	$14.30	$0.00	$66.29
	06/01/2015	$42.73	$10.00	$14.30	$0.00	$67.03
	12/01/2015	$43.97	$10.00	$14.30	$0.00	$68.27
	06/01/2016	$44.72	$10.00	$14.30	$0.00	$69.02
	12/01/2016	$45.95	$10.00	$14.30	$0.00	$70.25
	06/01/2017	$46.94	$10.00	$14.30	$0.00	$71.24
	12/01/2017	$47.93	$10.00	$14.30	$0.00	$72.23
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PAINTER (BRIDGES/TANKS) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2015	$47.66	$7.85	$16.10	$0.00	$71.61
	07/01/2015	$48.56	$7.85	$16.10	$0.00	$72.51
	01/01/2016	$49.51	$7.85	$16.10	$0.00	$73.46
	07/01/2016	$50.46	$7.85	$16.10	$0.00	$74.41
	01/01/2017	$51.41	$7.85	$16.10	$0.00	$75.36

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.83	$7.85	$0.00	$0.00	$31.68
2	55	$26.21	$7.85	$3.66	$0.00	$37.72
3	60	$28.60	$7.85	$3.99	$0.00	$40.44
4	65	$30.98	$7.85	$4.32	$0.00	$43.15
5	70	$33.36	$7.85	$14.11	$0.00	$55.32
6	75	$35.75	$7.85	$14.44	$0.00	$58.04
7	80	$38.13	$7.85	$14.77	$0.00	$60.75
8	90	$42.89	$7.85	$15.44	$0.00	$66.18

Effective Date - 07/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.28	$7.85	$0.00	$0.00	$32.13
2	55	$26.71	$7.85	$3.66	$0.00	$38.22
3	60	$29.14	$7.85	$3.99	$0.00	$40.98
4	65	$31.56	$7.85	$4.32	$0.00	$43.73
5	70	$33.99	$7.85	$14.11	$0.00	$55.95
6	75	$36.42	$7.85	$14.44	$0.00	$58.71
7	80	$38.85	$7.85	$14.77	$0.00	$61.47
8	90	$43.70	$7.85	$15.44	$0.00	$66.99

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, NEW) * * If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	01/01/2015	$38.56	$7.85	$16.10	$0.00	$62.51
	07/01/2015	$39.46	$7.85	$16.10	$0.00	$63.41
	01/01/2016	$40.41	$7.85	$16.10	$0.00	$64.36
	07/01/2016	$41.36	$7.85	$16.10	$0.00	$65.31
	01/01/2017	$42.31	$7.85	$16.10	$0.00	$66.26

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 01/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.28	$7.85	$0.00	$0.00	$27.13
2	55	$21.21	$7.85	$3.66	$0.00	$32.72
3	60	$23.14	$7.85	$3.99	$0.00	$34.98
4	65	$25.06	$7.85	$4.32	$0.00	$37.23
5	70	$26.99	$7.85	$14.11	$0.00	$48.95
6	75	$28.92	$7.85	$14.44	$0.00	$51.21
7	80	$30.85	$7.85	$14.77	$0.00	$53.47
8	90	$34.70	$7.85	$15.44	$0.00	$57.99

Effective Date - 07/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.73	$7.85	$0.00	$0.00	$27.58
2	55	$21.70	$7.85	$3.66	$0.00	$33.21
3	60	$23.68	$7.85	$3.99	$0.00	$35.52
4	65	$25.65	$7.85	$4.32	$0.00	$37.82
5	70	$27.62	$7.85	$14.11	$0.00	$49.58
6	75	$29.60	$7.85	$14.44	$0.00	$51.89
7	80	$31.57	$7.85	$14.77	$0.00	$54.19
8	90	$35.51	$7.85	$15.44	$0.00	$58.80

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2015	$36.62	$7.85	$16.10	$0.00	$60.57
	07/01/2015	$37.52	$7.85	$16.10	$0.00	$61.47
	01/01/2016	$38.47	$7.85	$16.10	$0.00	$62.42
	07/01/2016	$39.42	$7.85	$16.10	$0.00	$63.37
	01/01/2017	$40.37	$7.85	$16.10	$0.00	$64.32

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 01/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.31	$7.85	$0.00	$0.00	$26.16
2	55	$20.14	$7.85	$3.66	$0.00	$31.65
3	60	$21.97	$7.85	$3.99	$0.00	$33.81
4	65	$23.80	$7.85	$4.32	$0.00	$35.97
5	70	$25.63	$7.85	$14.11	$0.00	$47.59
6	75	$27.47	$7.85	$14.44	$0.00	$49.76
7	80	$29.30	$7.85	$14.77	$0.00	$51.92
8	90	$32.96	$7.85	$15.44	$0.00	$56.25

Effective Date - 07/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.76	$7.85	$0.00	$0.00	$26.61
2	55	$20.64	$7.85	$3.66	$0.00	$32.15
3	60	$22.51	$7.85	$3.99	$0.00	$34.35
4	65	$24.39	$7.85	$4.32	$0.00	$36.56
5	70	$26.26	$7.85	$14.11	$0.00	$48.22
6	75	$28.14	$7.85	$14.44	$0.00	$50.43
7	80	$30.02	$7.85	$14.77	$0.00	$52.64
8	90	$33.77	$7.85	$15.44	$0.00	$57.06

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (TRAFFIC MARKINGS) *LABORERS - ZONE 2*	12/01/2014	$30.65	$7.30	$12.30	$0.00	$50.25
	06/01/2015	$31.15	$7.30	$12.30	$0.00	$50.75
	12/01/2015	$31.65	$7.30	$12.30	$0.00	$51.25
	06/01/2016	$32.15	$7.30	$12.30	$0.00	$51.75
	12/01/2016	$32.90	$7.30	$12.30	$0.00	$52.50
For Apprentice rates see "Apprentice- LABORER"						
PAINTER / TAPER (BRUSH, NEW) * * If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	01/01/2015	$37.16	$7.85	$16.10	$0.00	$61.11
	07/01/2015	$38.06	$7.85	$16.10	$0.00	$62.01
	01/01/2016	$39.01	$7.85	$16.10	$0.00	$62.96
	07/01/2016	$39.96	$7.85	$16.10	$0.00	$63.91
	01/01/2017	$40.91	$7.85	$16.10	$0.00	$64.86

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 01/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.58	$7.85	$0.00	$0.00	$26.43
2	55	$20.44	$7.85	$3.66	$0.00	$31.95
3	60	$22.30	$7.85	$3.99	$0.00	$34.14
4	65	$24.15	$7.85	$4.32	$0.00	$36.32
5	70	$26.01	$7.85	$14.11	$0.00	$47.97
6	75	$27.87	$7.85	$14.44	$0.00	$50.16
7	80	$29.73	$7.85	$14.77	$0.00	$52.35
8	90	$33.44	$7.85	$15.44	$0.00	$56.73

Effective Date - 07/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.03	$7.85	$0.00	$0.00	$26.88
2	55	$20.93	$7.85	$3.66	$0.00	$32.44
3	60	$22.84	$7.85	$3.99	$0.00	$34.68
4	65	$24.74	$7.85	$4.32	$0.00	$36.91
5	70	$26.64	$7.85	$14.11	$0.00	$48.60
6	75	$28.55	$7.85	$14.44	$0.00	$50.84
7	80	$30.45	$7.85	$14.77	$0.00	$53.07
8	90	$34.25	$7.85	$15.44	$0.00	$57.54

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2015	$35.22	$7.85	$16.10	$0.00	$59.17
	07/01/2015	$36.12	$7.85	$16.10	$0.00	$60.07
	01/01/2016	$37.07	$7.85	$16.10	$0.00	$61.02
	07/01/2016	$38.02	$7.85	$16.10	$0.00	$61.97
	01/01/2017	$38.97	$7.85	$16.10	$0.00	$62.92

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 01/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$17.61	$7.85	$0.00	$0.00	$25.46
2	55	$19.37	$7.85	$3.66	$0.00	$30.88
3	60	$21.13	$7.85	$3.99	$0.00	$32.97
4	65	$22.89	$7.85	$4.32	$0.00	$35.06
5	70	$24.65	$7.85	$14.11	$0.00	$46.61
6	75	$26.42	$7.85	$14.44	$0.00	$48.71
7	80	$28.18	$7.85	$14.77	$0.00	$50.80
8	90	$31.70	$7.85	$15.44	$0.00	$54.99

Effective Date - 07/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.06	$7.85	$0.00	$0.00	$25.91
2	55	$19.87	$7.85	$3.66	$0.00	$31.38
3	60	$21.67	$7.85	$3.99	$0.00	$33.51
4	65	$23.48	$7.85	$4.32	$0.00	$35.65
5	70	$25.28	$7.85	$14.11	$0.00	$47.24
6	75	$27.09	$7.85	$14.44	$0.00	$49.38
7	80	$28.90	$7.85	$14.77	$0.00	$51.52
8	90	$32.51	$7.85	$15.44	$0.00	$55.80

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PANEL & PICKUP TRUCKS DRIVER *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2012	$30.28	$9.07	$8.00	$0.00	$47.35
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2014	$41.60	$9.80	$18.17	$0.00	$69.57
	08/01/2015	$43.10	$9.80	$18.17	$0.00	$71.07
PILE DRIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2014	$41.60	$9.80	$18.17	$0.00	$69.57
	08/01/2015	$43.10	$9.80	$18.17	$0.00	$71.07

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PILE DRIVER - Local 56 Zone 1*

Effective Date - 08/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.80	$9.80	$18.17	$0.00	$48.77
2	60	$24.96	$9.80	$18.17	$0.00	$52.93
3	70	$29.12	$9.80	$18.17	$0.00	$57.09
4	75	$31.20	$9.80	$18.17	$0.00	$59.17
5	80	$33.28	$9.80	$18.17	$0.00	$61.25
6	80	$33.28	$9.80	$18.17	$0.00	$61.25
7	90	$37.44	$9.80	$18.17	$0.00	$65.41
8	90	$37.44	$9.80	$18.17	$0.00	$65.41

Effective Date - 08/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.55	$9.80	$18.17	$0.00	$49.52
2	60	$25.86	$9.80	$18.17	$0.00	$53.83
3	70	$30.17	$9.80	$18.17	$0.00	$58.14
4	75	$32.33	$9.80	$18.17	$0.00	$60.30
5	80	$34.48	$9.80	$18.17	$0.00	$62.45
6	80	$34.48	$9.80	$18.17	$0.00	$62.45
7	90	$38.79	$9.80	$18.17	$0.00	$66.76
8	90	$38.79	$9.80	$18.17	$0.00	$66.76

Notes:

Apprentice to Journeyworker Ratio:1:3

PIPELAYER *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
PLUMBER & PIPEFITTER *PLUMBERS & PIPEFITTERS LOCAL 51*	09/01/2014	$35.88	$11.00	$15.35	$0.00	$62.23
	03/01/2015	$36.63	$11.00	$15.35	$0.00	$62.98
	09/01/2015	$37.38	$11.00	$15.35	$0.00	$63.73
	03/01/2016	$38.13	$11.00	$15.35	$0.00	$64.48

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PLUMBER/PIPEFITTER - Local 51*

Effective Date - 09/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$14.35	$11.00	$1.50	$0.00	$26.85
2	50	$17.94	$11.00	$1.50	$0.00	$30.44
3	60	$21.53	$11.00	$7.85	$0.00	$40.38
4	70	$25.12	$11.00	$11.66	$0.00	$47.78
5	80	$28.70	$11.00	$15.35	$0.00	$55.05

Effective Date - 03/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$14.65	$11.00	$1.50	$0.00	$27.15
2	50	$18.32	$11.00	$1.50	$0.00	$30.82
3	60	$21.98	$11.00	$7.85	$0.00	$40.83
4	70	$25.64	$11.00	$11.66	$0.00	$48.30
5	80	$29.30	$11.00	$15.35	$0.00	$55.65

Notes:

Steps 2000hrs. Prior 9/1/05; 40/40/45/50/55/60/65/75/80/85

Apprentice to Journeyworker Ratio:1:3

PNEUMATIC CONTROLS (TEMP.) *PLUMBERS & PIPEFITTERS LOCAL 51*	09/01/2014	$35.88	$11.00	$15.35	$0.00	$62.23
	03/01/2015	$36.63	$11.00	$15.35	$0.00	$62.98
	09/01/2015	$37.38	$11.00	$15.35	$0.00	$63.73
	03/01/2016	$38.13	$11.00	$15.35	$0.00	$64.48
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
PNEUMATIC DRILL/TOOL OPERATOR *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
POWDERMAN & BLASTER *LABORERS - ZONE 2*	12/01/2014	$31.65	$7.30	$12.30	$0.00	$51.25
	06/01/2015	$32.15	$7.30	$12.30	$0.00	$51.75
	12/01/2015	$32.65	$7.30	$12.30	$0.00	$52.25
	06/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75
	12/01/2016	$33.90	$7.30	$12.30	$0.00	$53.50
For apprentice rates see "Apprentice- LABORER"						
POWER SHOVEL/DERRICK/TRENCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$42.39	$10.00	$14.30	$0.00	$66.69
	06/01/2015	$43.14	$10.00	$14.30	$0.00	$67.44
	12/01/2015	$44.39	$10.00	$14.30	$0.00	$68.69
	06/01/2016	$45.14	$10.00	$14.30	$0.00	$69.44
	12/01/2016	$46.39	$10.00	$14.30	$0.00	$70.69
	06/01/2017	$47.39	$10.00	$14.30	$0.00	$71.69
	12/01/2017	$48.39	$10.00	$14.30	$0.00	$72.69
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PUMP OPERATOR (CONCRETE) *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$42.39	$10.00	$14.30	$0.00	$66.69
	06/01/2015	$43.14	$10.00	$14.30	$0.00	$67.44
	12/01/2015	$44.39	$10.00	$14.30	$0.00	$68.69
	06/01/2016	$45.14	$10.00	$14.30	$0.00	$69.44
	12/01/2016	$46.39	$10.00	$14.30	$0.00	$70.69
	06/01/2017	$47.39	$10.00	$14.30	$0.00	$71.69
	12/01/2017	$48.39	$10.00	$14.30	$0.00	$72.69
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$29.40	$10.00	$14.30	$0.00	$53.70
	06/01/2015	$29.92	$10.00	$14.30	$0.00	$54.22
	12/01/2015	$30.79	$10.00	$14.30	$0.00	$55.09
	06/01/2016	$31.31	$10.00	$14.30	$0.00	$55.61
	12/01/2016	$32.18	$10.00	$14.30	$0.00	$56.48
	06/01/2017	$32.87	$10.00	$14.30	$0.00	$57.17
	12/01/2017	$33.56	$10.00	$14.30	$0.00	$57.86
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY-MIX CONCRETE DRIVER *TEAMSTERS LOCAL 653*	08/01/2008	$19.76	$7.16	$4.21	$0.00	$31.13
RECLAIMERS *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$41.99	$10.00	$14.30	$0.00	$66.29
	06/01/2015	$42.73	$10.00	$14.30	$0.00	$67.03
	12/01/2015	$43.97	$10.00	$14.30	$0.00	$68.27
	06/01/2016	$44.72	$10.00	$14.30	$0.00	$69.02
	12/01/2016	$45.95	$10.00	$14.30	$0.00	$70.25
	06/01/2017	$46.94	$10.00	$14.30	$0.00	$71.24
	12/01/2017	$47.93	$10.00	$14.30	$0.00	$72.23
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
RESIDENTIAL WOOD FRAME (All Other Work) *CARPENTERS -ZONE 2 (Residential Wood)*	04/01/2011	$24.24	$8.67	$15.51	$0.00	$48.42
RESIDENTIAL WOOD FRAME CARPENTER ** ** The Residential Wood Frame Carpenter classification applies only to the construction of new, wood frame residences that do not exceed four stories including the basement.*CARPENTERS -ZONE 2 (Residential Wood)*	05/01/2011	$24.24	$6.34	$6.23	$0.00	$36.81

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

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 05/01/2011

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$14.54	$6.34	$0.00	$0.00	$20.88
2	60	$14.54	$6.34	$6.23	$0.00	$27.11
3	65	$15.76	$6.34	$6.23	$0.00	$28.33
4	70	$16.97	$6.34	$6.23	$0.00	$29.54
5	75	$18.18	$6.34	$6.23	$0.00	$30.75
6	80	$19.39	$6.34	$6.23	$0.00	$31.96
7	85	$20.60	$6.34	$6.23	$0.00	$33.17
8	90	$21.82	$6.34	$6.23	$0.00	$34.39

Notes:

Apprentice to Journeyworker Ratio:1:5

RIDE-ON MOTORIZED BUGGY OPERATOR *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
ROLLER/SPREADER/MULCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$41.99	$10.00	$14.30	$0.00	$66.29
	06/01/2015	$42.73	$10.00	$14.30	$0.00	$67.03
	12/01/2015	$43.97	$10.00	$14.30	$0.00	$68.27
	06/01/2016	$44.72	$10.00	$14.30	$0.00	$69.02
	12/01/2016	$45.95	$10.00	$14.30	$0.00	$70.25
	06/01/2017	$46.94	$10.00	$14.30	$0.00	$71.24
	12/01/2017	$47.93	$10.00	$14.30	$0.00	$72.23
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg) *ROOFERS LOCAL 33*	02/01/2015	$40.11	$10.50	$11.60	$0.00	$62.21
	08/01/2015	$41.01	$10.50	$11.60	$0.00	$63.11
	02/01/2016	$41.91	$10.50	$11.60	$0.00	$64.01

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ROOFER - Local 33*

Effective Date - 02/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.06	$10.50	$3.38	$0.00	$33.94
2	60	$24.07	$10.50	$11.60	$0.00	$46.17
3	65	$26.07	$10.50	$11.60	$0.00	$48.17
4	75	$30.08	$10.50	$11.60	$0.00	$52.18
5	85	$34.09	$10.50	$11.60	$0.00	$56.19

Effective Date - 08/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.51	$10.50	$3.38	$0.00	$34.39
2	60	$24.61	$10.50	$11.60	$0.00	$46.71
3	65	$26.66	$10.50	$11.60	$0.00	$48.76
4	75	$30.76	$10.50	$11.60	$0.00	$52.86
5	85	$34.86	$10.50	$11.60	$0.00	$56.96

Notes: ** 1:5, 2:6-10, the 1:10; Reroofing: 1:4, then 1:1
Step 1 is 2000 hrs.; Steps 2-5 are 1000 hrs.

Apprentice to Journeyworker Ratio:**

ROOFER SLATE / TILE / PRECAST CONCRETE *ROOFERS LOCAL 33*	02/01/2015	$40.36	$10.50	$11.60	$0.00	$62.46
	08/01/2015	$41.26	$10.50	$11.60	$0.00	$63.36
	02/01/2016	$42.16	$10.50	$11.60	$0.00	$64.26
For apprentice rates see "Apprentice- ROOFER"						
SHEETMETAL WORKER *SHEETMETAL WORKERS LOCAL 17 - A*	02/01/2015	$43.69	$9.82	$20.54	$2.19	$76.24
	08/01/2015	$44.69	$9.82	$20.54	$2.19	$77.24
	02/01/2016	$45.69	$9.82	$20.54	$2.19	$78.24
	08/01/2016	$46.84	$9.82	$20.54	$2.19	$79.39
	02/01/2017	$47.94	$9.82	$20.54	$2.19	$80.49
	08/01/2017	$49.04	$9.82	$20.54	$2.19	$81.59
	02/01/2018	$50.19	$9.82	$20.54	$2.19	$82.74

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 02/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$17.48	$9.82	$4.58	$0.00	$31.88
2	40	$17.48	$9.82	$4.58	$0.00	$31.88
3	45	$19.66	$9.82	$9.09	$1.16	$39.73
4	45	$19.66	$9.82	$9.09	$1.16	$39.73
5	50	$21.85	$9.82	$9.91	$1.25	$42.83
6	50	$21.85	$9.82	$10.16	$1.25	$43.08
7	60	$26.21	$9.82	$11.55	$1.43	$49.01
8	65	$28.40	$9.82	$12.38	$1.52	$52.12
9	75	$32.77	$9.82	$14.02	$1.70	$58.31
10	85	$37.14	$9.82	$15.16	$1.86	$63.98

Effective Date - 08/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$17.88	$9.82	$4.58	$0.00	$32.28
2	40	$17.88	$9.82	$4.58	$0.00	$32.28
3	45	$20.11	$9.82	$9.09	$1.17	$40.19
4	45	$20.11	$9.82	$9.09	$1.17	$40.19
5	50	$22.35	$9.82	$9.91	$1.26	$43.34
6	50	$22.35	$9.82	$10.16	$1.27	$43.60
7	60	$26.81	$9.82	$11.55	$1.45	$49.63
8	65	$29.05	$9.82	$12.38	$1.54	$52.79
9	75	$33.52	$9.82	$14.02	$1.72	$59.08
10	85	$37.99	$9.82	$15.16	$1.89	$64.86

Notes:

Steps are 6 mos.

Apprentice to Journeyworker Ratio:1:4

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

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SIGN ERECTOR - Local 35 Zone 2*

Effective Date - 06/01/2013

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

Notes:

Steps are 4 mos.

Apprentice to Journeyworker Ratio:1:1

SPECIALIZED EARTH MOVING EQUIP < 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2014	$31.59	$9.91	$9.33	$0.00	$50.83
	06/01/2015	$31.94	$9.91	$9.33	$0.00	$51.18
	08/01/2015	$31.94	$10.41	$9.33	$0.00	$51.68
	12/01/2015	$31.94	$10.41	$10.08	$0.00	$52.43
	06/01/2016	$32.44	$10.41	$10.08	$0.00	$52.93
	08/01/2016	$32.44	$10.91	$10.08	$0.00	$53.43
	12/01/2016	$32.44	$10.91	$10.89	$0.00	$54.24
SPECIALIZED EARTH MOVING EQUIP > 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2014	$31.88	$9.91	$9.33	$0.00	$51.12
	06/01/2015	$32.23	$9.91	$9.33	$0.00	$51.47
	08/01/2015	$32.23	$10.41	$9.33	$0.00	$51.97
	12/01/2015	$32.23	$10.41	$10.08	$0.00	$52.72
	06/01/2016	$32.73	$10.41	$10.08	$0.00	$53.22
	08/01/2016	$32.73	$10.91	$10.08	$0.00	$53.72
	12/01/2016	$32.73	$10.91	$10.89	$0.00	$54.53
SPRINKLER FITTER *SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1*	01/01/2015	$53.58	$8.42	$14.75	$0.00	$76.75
	03/01/2015	$54.58	$8.42	$14.75	$0.00	$77.75
	10/01/2015	$55.73	$8.42	$14.75	$0.00	$78.90
	01/01/2016	$55.73	$8.67	$14.90	$0.00	$79.30
	03/01/2016	$56.73	$8.67	$14.90	$0.00	$80.30
	10/01/2016	$57.88	$8.67	$14.90	$0.00	$81.45
	03/01/2017	$58.88	$8.67	$14.90	$0.00	$82.45

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 01/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$18.75	$8.42	$8.40	$0.00	$35.57
2	40	$21.43	$8.42	$8.40	$0.00	$38.25
3	45	$24.11	$8.42	$8.40	$0.00	$40.93
4	50	$26.79	$8.42	$8.40	$0.00	$43.61
5	55	$29.47	$8.42	$8.40	$0.00	$46.29
6	60	$32.15	$8.42	$8.40	$0.00	$48.97
7	65	$34.83	$8.42	$8.40	$0.00	$51.65
8	70	$37.51	$8.42	$8.40	$0.00	$54.33
9	75	$40.19	$8.42	$8.40	$0.00	$57.01
10	80	$42.86	$8.42	$8.40	$0.00	$59.68

Effective Date - 03/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$19.10	$8.42	$8.40	$0.00	$35.92
2	40	$21.83	$8.42	$8.40	$0.00	$38.65
3	45	$24.56	$8.42	$8.40	$0.00	$41.38
4	50	$27.29	$8.42	$8.40	$0.00	$44.11
5	55	$30.02	$8.42	$8.40	$0.00	$46.84
6	60	$32.75	$8.42	$8.40	$0.00	$49.57
7	65	$35.48	$8.42	$8.40	$0.00	$52.30
8	70	$38.21	$8.42	$8.40	$0.00	$55.03
9	75	$40.94	$8.42	$8.40	$0.00	$57.76
10	80	$43.66	$8.42	$8.40	$0.00	$60.48

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 *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$41.99	$10.00	$14.30	$0.00	$66.29
	06/01/2015	$42.73	$10.00	$14.30	$0.00	$67.03
	12/01/2015	$43.97	$10.00	$14.30	$0.00	$68.27
	06/01/2016	$44.72	$10.00	$14.30	$0.00	$69.02
	12/01/2016	$45.95	$10.00	$14.30	$0.00	$70.25
	06/01/2017	$46.94	$10.00	$14.30	$0.00	$71.24
	12/01/2017	$47.93	$10.00	$14.30	$0.00	$72.23

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$41.99	$10.00	$14.30	$0.00	$66.29
	06/01/2015	$42.73	$10.00	$14.30	$0.00	$67.03
	12/01/2015	$43.97	$10.00	$14.30	$0.00	$68.27
	06/01/2016	$44.72	$10.00	$14.30	$0.00	$69.02
	12/01/2016	$45.95	$10.00	$14.30	$0.00	$70.25
	06/01/2017	$46.94	$10.00	$14.30	$0.00	$71.24
	12/01/2017	$47.93	$10.00	$14.30	$0.00	$72.23
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TELECOMMUNICATION TECHNICIAN *ELECTRICIANS LOCAL 223*	09/01/2014	$31.71	$8.00	$9.38	$0.00	$49.09
	09/01/2015	$32.56	$8.40	$9.59	$0.00	$50.55
	09/01/2016	$33.33	$8.90	$9.78	$0.00	$52.01

Apprentice - *TELECOMMUNICATION TECHNICIAN - Local 223*

Effective Date - 09/01/2014

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	0	$0.00	$0.00	$0.00	$0.00	$0.00

Notes: See Electrician Apprentice Wages
Steps are 750hrs
Telecom Apprentice Wages shall be the same as the Electrician Apprentice Wages

Apprentice to Journeyworker Ratio:2:3

TERRAZZO FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	02/01/2015	$47.90	$10.18	$18.50	$0.00	$76.58
	08/01/2015	$48.80	$10.18	$18.57	$0.00	$77.55
	02/01/2016	$49.37	$10.18	$18.57	$0.00	$78.12
	08/01/2016	$50.27	$10.18	$18.65	$0.00	$79.10
	02/01/2017	$50.84	$10.18	$18.65	$0.00	$79.67

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 02/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.95	$10.18	$18.50	$0.00	$52.63
2	60	$28.74	$10.18	$18.50	$0.00	$57.42
3	70	$33.53	$10.18	$18.50	$0.00	$62.21
4	80	$38.32	$10.18	$18.50	$0.00	$67.00
5	90	$43.11	$10.18	$18.50	$0.00	$71.79

Effective Date - 08/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.40	$10.18	$18.57	$0.00	$53.15
2	60	$29.28	$10.18	$18.57	$0.00	$58.03
3	70	$34.16	$10.18	$18.57	$0.00	$62.91
4	80	$39.04	$10.18	$18.57	$0.00	$67.79
5	90	$43.92	$10.18	$18.57	$0.00	$72.67

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER *LABORERS - FOUNDATION AND MARINE*	12/01/2014	$35.95	$7.30	$13.15	$0.00	$56.40
	06/01/2015	$36.70	$7.30	$13.15	$0.00	$57.15
	12/01/2015	$37.45	$7.30	$13.15	$0.00	$57.90
	06/01/2016	$38.20	$7.30	$13.15	$0.00	$58.65
	12/01/2016	$39.20	$7.30	$13.15	$0.00	$59.65
For apprentice rates see "Apprentice- LABORER"						
TEST BORING DRILLER HELPER *LABORERS - FOUNDATION AND MARINE*	12/01/2014	$34.67	$7.30	$13.15	$0.00	$55.12
	06/01/2015	$35.42	$7.30	$13.15	$0.00	$55.87
	12/01/2015	$36.17	$7.30	$13.15	$0.00	$56.62
	06/01/2016	$36.92	$7.30	$13.15	$0.00	$57.37
	12/01/2016	$37.92	$7.30	$13.15	$0.00	$58.37
For apprentice rates see "Apprentice- LABORER"						
TEST BORING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2014	$34.55	$7.30	$13.15	$0.00	$55.00
	06/01/2015	$35.30	$7.30	$13.15	$0.00	$55.75
	12/01/2015	$36.05	$7.30	$13.15	$0.00	$56.50
	06/01/2016	$36.80	$7.30	$13.15	$0.00	$57.25
	12/01/2016	$37.80	$7.30	$13.15	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TRACTORS/PORTABLE STEAM GENERATORS *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$41.99	$10.00	$14.30	$0.00	$66.29
	06/01/2015	$42.73	$10.00	$14.30	$0.00	$67.03
	12/01/2015	$43.97	$10.00	$14.30	$0.00	$68.27
	06/01/2016	$44.72	$10.00	$14.30	$0.00	$69.02
	12/01/2016	$45.95	$10.00	$14.30	$0.00	$70.25
	06/01/2017	$46.94	$10.00	$14.30	$0.00	$71.24
	12/01/2017	$47.93	$10.00	$14.30	$0.00	$72.23
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2014	$32.17	$9.91	$9.33	$0.00	$51.41
	06/01/2015	$32.52	$9.91	$9.33	$0.00	$51.76
	08/01/2015	$32.52	$10.41	$9.33	$0.00	$52.26
	12/01/2015	$32.52	$10.41	$10.08	$0.00	$53.01
	06/01/2016	$33.02	$10.41	$10.08	$0.00	$53.51
	08/01/2016	$33.02	$10.91	$10.08	$0.00	$54.01
	12/01/2016	$33.02	$10.91	$10.89	$0.00	$54.82
TUNNEL WORK - COMPRESSED AIR *LABORERS (COMPRESSED AIR)*	12/01/2014	$46.83	$7.30	$13.55	$0.00	$67.68
	06/01/2015	$47.58	$7.30	$13.55	$0.00	$68.43
	12/01/2015	$48.33	$7.30	$13.55	$0.00	$69.18
	06/01/2016	$49.08	$7.30	$13.55	$0.00	$69.93
	12/01/2016	$50.08	$7.30	$13.55	$0.00	$70.93
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) *LABORERS (COMPRESSED AIR)*	12/01/2014	$48.83	$7.30	$13.55	$0.00	$69.68
	06/01/2015	$49.58	$7.30	$13.55	$0.00	$70.43
	12/01/2015	$50.33	$7.30	$13.55	$0.00	$71.18
	06/01/2016	$51.08	$7.30	$13.55	$0.00	$71.93
	12/01/2016	$52.08	$7.30	$13.55	$0.00	$72.93
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR *LABORERS (FREE AIR TUNNEL)*	12/01/2014	$38.90	$7.30	$13.55	$0.00	$59.75
	06/01/2015	$39.65	$7.30	$13.55	$0.00	$60.50
	12/01/2015	$40.40	$7.30	$13.55	$0.00	$61.25
	06/01/2016	$41.15	$7.30	$13.55	$0.00	$62.00
	12/01/2016	$42.15	$7.30	$13.55	$0.00	$63.00
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR (HAZ. WASTE) *LABORERS (FREE AIR TUNNEL)*	12/01/2014	$40.90	$7.30	$13.55	$0.00	$61.75
	06/01/2015	$41.65	$7.30	$13.55	$0.00	$62.50
	12/01/2015	$42.40	$7.30	$13.55	$0.00	$63.25
	06/01/2016	$43.15	$7.30	$13.55	$0.00	$64.00
	12/01/2016	$44.15	$7.30	$13.55	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2014	$31.59	$9.91	$9.33	$0.00	$50.83
	06/01/2015	$31.94	$9.91	$9.33	$0.00	$51.18
	08/01/2015	$31.94	$10.41	$9.33	$0.00	$51.68
	12/01/2015	$31.94	$10.41	$10.08	$0.00	$52.43
	06/01/2016	$32.44	$10.41	$10.08	$0.00	$52.93
	08/01/2016	$32.44	$10.91	$10.08	$0.00	$53.43
	12/01/2016	$32.44	$10.91	$10.89	$0.00	$54.24

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
WAGON DRILL OPERATOR *LABORERS - ZONE 2*	12/01/2014	$30.90	$7.30	$12.30	$0.00	$50.50
	06/01/2015	$31.40	$7.30	$12.30	$0.00	$51.00
	12/01/2015	$31.90	$7.30	$12.30	$0.00	$51.50
	06/01/2016	$32.40	$7.30	$12.30	$0.00	$52.00
	12/01/2016	$33.15	$7.30	$12.30	$0.00	$52.75
For apprentice rates see "Apprentice- LABORER"						
WASTE WATER PUMP OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2014	$42.39	$10.00	$14.30	$0.00	$66.69
	06/01/2015	$43.14	$10.00	$14.30	$0.00	$67.44
	12/01/2015	$44.39	$10.00	$14.30	$0.00	$68.69
	06/01/2016	$45.14	$10.00	$14.30	$0.00	$69.44
	12/01/2016	$46.39	$10.00	$14.30	$0.00	$70.69
	06/01/2017	$47.39	$10.00	$14.30	$0.00	$71.69
	12/01/2017	$48.39	$10.00	$14.30	$0.00	$72.69
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER *PLUMBERS & PIPEFITTERS LOCAL 51*	09/01/2014	$35.88	$11.00	$15.35	$0.00	$62.23
	03/01/2015	$36.63	$11.00	$15.35	$0.00	$62.98
	09/01/2015	$37.38	$11.00	$15.35	$0.00	$63.73
	03/01/2016	$38.13	$11.00	$15.35	$0.00	$64.48
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$25.66	$8.70	$4.48	$0.00	$38.84
For apprentice rates see "Apprentice- LINEMAN"						
CABLEMAN (Underground Ducts & Cables) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$36.55	$8.70	$6.58	$0.00	$51.83
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN CDL *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$29.94	$8.70	$6.05	$0.00	$44.69
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$23.52	$8.70	$5.24	$0.00	$37.46
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class A CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$36.35	$8.70	$9.43	$0.00	$54.48
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class B CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$32.08	$8.70	$6.59	$0.00	$47.37
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$23.52	$8.70	$3.72	$0.00	$35.94
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN -Inexperienced (<2000 Hrs.) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$19.25	$8.70	$2.85	$0.00	$30.80
For apprentice rates see "Apprentice- LINEMAN"						
JOURNEYMAN LINEMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2013	$42.77	$8.70	$11.78	$0.00	$63.25

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 09/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$25.66	$8.70	$4.24	$0.00	$38.60
2	65	$27.80	$8.70	$4.71	$0.00	$41.21
3	70	$29.94	$8.70	$5.43	$0.00	$44.07
4	75	$32.08	$8.70	$6.16	$0.00	$46.94
5	80	$34.22	$8.70	$6.88	$0.00	$49.80
6	85	$36.35	$8.70	$7.62	$0.00	$52.67
7	90	$38.49	$8.70	$8.83	$0.00	$56.02

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	07/16/2012	$26.33	$4.18	$2.79	$0.00	$33.30
TELEDATA LINEMAN/EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	07/16/2012	$24.78	$4.18	$2.74	$0.00	$31.70
TELEDATA WIREMAN/INSTALLER/TECHNICIAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	07/16/2012	$24.78	$4.18	$2.74	$0.00	$31.70
TREE TRIMMER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/29/2012	$17.18	$3.37	$0.00	$0.00	$20.55

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

TREE TRIMMER GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/29/2012	$15.15	$3.37	$0.00	$0.00	$18.52

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

Additional Apprentice Information:

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

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

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

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

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 _____

MASSACHUSETTS WEEKLY CERTIFIED PAYROLL REPORT FORM

Company's Name:	Address:	Phone No.:	Payroll No.:

Employer's Signature:	Title:	Contract No:	Tax Payer ID Number	Work Week Ending:

Awarding Authority's Name:	Public Works Project Name:	Public Works Project Location:	Min. Wage Rate Sheet Number

General / Prime Contractor's Name:	Subcontractor's Name:		"Employer" Hourly Fringe Benefit Contributions

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

Are all apprentice employees identified above currently registered with the MA DLS's Division of Apprentice 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 Apprentice Standards.

No apprentices are identified above ☐

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
/ /

ATTACHMENT 2

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS and PLANS

All work done under this Contract shall be in conformance with the latest version of the Commonwealth of Massachusetts “Standard Specifications” which hereafter shall include but not be limited to the Massachusetts Highway Department Standard Specifications for Highways and Bridges dated 1988, as amended, the Supplemental Specifications dated June 15, 2012, the 2012 Construction Standard Details, the 1996 Construction and Traffic Standard Details (as relates to traffic standard details only); the 2009 Manual on Uniform Traffic Control Devices for Streets and Highways with Massachusetts Amendments and the Standard Municipal Traffic Code; the 1990 Standard Drawings for Signs and Supports, the 1968 Standard Drawings for Traffic Signals and Highway Lighting, and the latest edition of American Standard for Nursery Stock will govern.

All work done under this Contract shall also be in conformance with the Plans and these Technical Specifications.

The work to be done under this contract consists of, but shall not be limited, to the following: the construction of approximately 6,000 linear feet of gravity sewer, sewer service connections, one (1) wastewater pumping station, approximately 3,500 linear feet of force main, and associated paving.

TECHNICAL SPECIFICATIONS

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NOTE: Bidders shall check the attached documents with the above list before submitting a bid.

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DOCUMENT 00100

INSTRUCTIONS AND INFORMATION FOR BIDDERS

1.00 Project Identification

1.01 Engineer

1.02 Receipt of Bids

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1.11 Laws and Regulations

1.12 Inspection of the Work

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1.14 Guarantees

1.15 Record Keeping

1.16 Listed Hazardous Waste Sites

1.00 PROJECT IDENTIFICATION

A. Owner: Town of Plymouth

B. Awarding Authority: Procurement Division

C. Mailing Address: 11 Lincoln Street
Plymouth, Massachusetts, 02360

D. Project Name: Samoset Street Sewer System Expansion
Contract No. 2014-Phase 1

E. Funding: Local

1.01 ENGINEER

A. The Engineer for this Project is AECOM Technical Services, Inc., 250 Apollo Drive, Chelmsford, MA 01824.

1.02 RECEIPT OF BIDS

A. Bids for the Project will be received by the Awarding Authority at the time and place stated in the INVITIATON FOR BIDS, and then at said place publicly opened and read aloud.

B. For Additional information on the receiving of Bids by the Awarding Authority, See INVITIATION FOR BID and GENERAL INFORMATION.

1.03 MODIFICATIONS AND WITHDRAWAL OF BIDS – SEE GENERAL INFORMATION, PARAGRAPH D.

1.04 EXAMINATION OF CONTRACT DOCUMENTS AND SITE (S)

A. Each Bidder is responsible for inspecting the site(s) and for reading and being thoroughly familiar with the Contract Documents. The failure or omission of any Bidder to do any of the foregoing shall in no way relieve any Bidder from any obligation in respect to its Bid.

B. Bidders must satisfy themselves of the accuracy of the estimated quantities in the Bid schedule by examination of the site(s) and a review of the Contract Documents. After Bids have been submitted, the Bidder shall not assert that there was a misunderstanding concerning the quantities of Work or of the nature of the Work to be done.

C. The Contract Documents contain the provisions required for the construction of the Project. Information obtained from an officer, agent, or employee of the Owner or any other person shall not affect the risks or obligations assumed by the Bidder or relieve it from fulfilling any of the conditions of the Contract.

D. The Owner shall provide to Bidders, prior to bidding, all information that is pertinent to, and delineates and describes, the land owned and rights-of-way acquired or to be acquired.

1.05 ADDENDA AND INTERPRETATIONS – SEE GENERAL INFORMATION.

1.06 BIDS, BONDS, AND AWARD OF CONTRACT - SEE INVITATION FOR BID AND GENERAL INFORMATION.

1.07 EXECUTION OF THE AGREEMENT

A. The party to whom the Contract is awarded will be required to execute DOCUMENT 00500, FORM FOR AGREEMENT, and obtain the Performance Bond, Payment Bond and Certificates of Insurance within ten (10) calendar days from the date when DOCUMENT 00430, NOTICE OF AWARD, is delivered to the Bidder. If any Bidder fails to execute DOCUMENT 00500, FORM FOR AGREEMENT and furnish a Performance Bond and a labor and materials or Payment Bond as stated in its Bid, its Bid deposit shall become the property of the Owner, as liquidated damages, provided that in case of death, disability or other unforeseen circumstances affecting the Bidder, its Bid deposit may be returned to it, provided further that the amount of the Bid deposit to be retained shall not exceed the difference between the low Bid and the Bid of the next lowest, eligible Bidder.

B. The Owner, within ten (10) days of receipt of acceptable Performance Bond, Payment Bond, Certificates of Insurance and DOCUMENT 00500, FORM FOR AGREEMENT signed by the party to whom the Contract was awarded, shall sign DOCUMENT 00500, FORM FOR AGREEMENT and return to such party an executed duplicate. Should the Owner not execute DOCUMENT 00500, FORM FOR AGREEMENT within such period, the Bidder may by written notice withdraw its signed DOCUMENT 00500, FORM FOR AGREEMENT. Such notice of withdrawal shall be effective upon receipt of the notice by the Owner.

1.08 NOTICE TO PROCEED

A. DOCUMENT 00650, NOTICE TO PROCEED shall be issued within ten (10) days of execution of OWNER/CONTRACTOR AGREEMENT by the Owner. Should there be reasons why DOCUMENT 00650, NOTICE TO PROCEED cannot be issued within such period, the time may be extended by mutual agreement between the Owner and Contractor.

B. If DOCUMENT 00650, NOTICE TO PROCEED has not been issued within the ten (10) day period or within the period mutually agreed upon, the Contractor may terminate OWNER/CONTRACTOR AGREEMENT without further liability on the part of either party.

1.09 TIME SCHEDULE FOR COMPLETION OF WORK – SEE INVITATION FOR BID

1.10 WAGE RATES – SEE INVITATION FOR BID

1.11 LAWS AND REGULATIONS

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

B. All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Contract throughout.

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

D. This Project is subject to the requirements of the Massachusetts Diesel Retrofit Program (MDRP). Bidders must submit a signed and dated Statement of Intent to Comply form as part of their Bid proposal.

E. The Contract is being bid on under the provisions of M.G.L. c.30, s39M.

G. The Contractors' attention is directed to the fact that the new Massachusetts Trench Regulations ("Jackie's Law") went into effect on March 01, 2009 (520 CMR 14.00: Excavation and Trench Safety). The regulation requires excavators to obtain a permit prior to creating a trench on public or private property, and to cover, barricade or backfill unattended trenches.

1.12 INSPECTION OF THE WORK

A. The Contractor shall provide at all times proper facilities for access and inspection by representatives of the Owner, federal, state or other agency having jurisdiction over the Work of this Project.

1.13 SALES TAX – SEE GENERAL INFORMATION.

1.14 GUARANTEES

A. In addition to other guarantees due the Owner, the Contractor guarantees that the Work and services to be performed under the Contract, and all workmanship, materials and equipment performed, furnished, used or installed in the construction shall be free from defects and flaws, and shall be performed and furnished in strict accordance with the Contract Documents, that the strength of all parts of all manufactured equipment shall be adequate and as specified and that the performance test requirements of the Contract shall be fulfilled. If part of the Work is accepted in accordance with that subsection of this Agreement titled "Partial Acceptance", the guarantee for that part of the Work shall be for a period of one year from the date fixed for such acceptance. The Performance Bond shall remain in full force and effect through the Guarantee Period.

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

1.15 RECORD KEEPING

A. The Contractor is reminded that the provisions of M.G.L. c.30, s39R relative to record keeping apply to this Contract. A copy of c.30, s.39R is included in DOCUMENT 00855, SPECIAL CONDITIONS, COMMONWEALTH OF MASSACHUSETTS, of the Contract Documents. A brief summary of the requirements is, as follows:

1. The Contractor and all Subcontractors shall maintain books, records, and accounts at least six years after the final payment. They will be subject to inspection by the Awarding Authority, officers of the Inspector General, or the Deputy Commissioner of Capital Asset Management and Maintenance.

2. Any changes in record keeping or recording transactions, which affect the Awarding Authority, shall be explained along with a letter from the Contractor's independent certified public accountant approving or otherwise commenting on the changes.

3. The Contractor shall file with the Awarding Authority a statement of management as to whether the system of internal accounting controls has been established.

4. The Contractor shall file with the Awarding Authority a statement prepared and signed by an independent certified public accountant that an examination has been made of internal accounting controls.

1.16 LISTED HAZARDOUS WASTE SITES

A. The Bidder is advised that there are sites located near the Project area which appear on the Department of Environmental Protection most recent list of hazardous waste sites and that this Project could be affected. A current list of all reported hazardous waste sites is available on the Massachusetts Department of Environmental Protection (MassDEP) website http://www.mass.gov/eea/agencies/massdep/cleanup/sites/

B. All necessary and required precautions and federal, state and local laws and regulations should be followed when working in or near these sites. The Contractor is further advised that handling and disposal of asbestos cement piping materials, if encountered on this Project, must comply with all necessary and required precautions, and federal, state and local laws and regulations should be followed when performing the Work.

END OF DOCUMENT

DOCUMENT 00310

BID BOND

Know all men by these presents, that we, the undersigned, _____
_____ as Principal, and
_____ as Surety, are hereby held and firmly bound unto the Town of Plymouth, acting by and through its Board of Selectmen (Sewer Commissioners) as Owner in the penal sum of five (5) percent of the value of the Bid for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed, this _____ day of_____, 20_____.

The Condition of the above obligation is such that whereas the Principal has submitted to the, Town of Plymouth, acting by and through its Board of Selectmen (Sewer Commissioners), 11 Lincoln Street, Plymouth Country, Plymouth, Massachusetts, 02360 a certain Bid, attached hereto and hereby made a part hereof to enter into a Contract in writing, for Contract No. 2014-Phase 1, Samoset Street Sewer System Expansion, Plymouth, Massachusetts.

Now, therefore,

(a) If said Bid shall be rejected, or

(b) If said Bid shall be accepted and the Principal shall execute and deliver a Contract in the Form of Contract attached hereto (properly completed in accordance with said Bid) and shall furnish a Bond for his faithful performance of said Contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid,

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

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

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

_____ (L.S.)
Principal

_____
Surety

By: _____

Important - Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the Project is located.

END OF DOCUMENT

DOCUMENT 00375

STATEMENT OF TAX COMPLIANCE

I, _____, as _____ of
(Title)

_____, whose principal place of
(Business)

business is located at _____, do hereby certify that the above-named

_____ has complied with all laws of the Commonwealth of

Massachusetts relating to taxes, in accordance with the provisions of M.G.L. c.62C, s.49A, as amended.

Signed under the penalties of perjury this _____ day of _____, 20_____.

_____
Signed by Officer of Corporation

_____
Title

County of _____

_____ then personally appeared and acknowledged the foregoing instrument to be the free act and deed of _____ before me.

Sworn to me this _____ day of _____ 20_____.

_____
NOTARY PUBLIC

My Commission Expires: _____

END OF DOCUMENT

DOCUMENT 00430

NOTICE OF AWARD

To: _____

Project Description: Contract No. 2014-Phase 1, Samoset Street Sewer System Expansion, Plymouth, Massachusetts.

The Owner has considered the Bid submitted by you for the above described work in response to its INVITATION FOR BID dated _____ , GENERAL INFORMATION, and DOCUMENT 00100, INSTRUCTIONS AND INFORMATION FOR BIDDERS. You are hereby notified that your Bid has been accepted in the amount of $ _____.

You are required by DOCUMENT 00100, INSTRUCTIONS AND INFORMATION FOR BIDDERS to execute OWNER/CONTRACTOR AGREEMENT and furnish the required Contractor's Performance Bond, Payment Bond and Certificates of Insurance within ten (10) calendar days from the date of this Notice of Award. If you fail to execute said Agreement and to furnish said Bonds within ten (10) days from the date of this Notice of Award, said Owner will be entitled to consider all your rights arising out of the Owner's acceptance of your Bid as abandoned and as a forfeiture of your Bid Bond. The Owner will be entitled to such other rights as may be granted by law. You are required to return an acknowledged copy of this Notice of Award to the Owner. Dated this _____ day of _____, 20___.

Owner: Town of Plymouth

Procurement Division

_____

Pamela D. Hager, Procurement Officer

Contractor:

Acceptance of Notice:

Receipt of the above Notice of Award is hereby

acknowledged by:

_____

Name and Title

this _____day of _____, _____

By: _____

(Authorized Signature)

Title: _____

END OF DOCUMENT

DOCUMENT 00600

PAYMENT BOND

Know all men by these presents that

_____

(Name of Contractor)

_____

(Address of Contractor)

a _____, hereinafter called Principal, and

(Corporation, Partnership or Individual)

_____

(Name of Surety)

_____

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto the Town of Plymouth Massachusetts, acting by and through its Procurement Division, hereinafter called "Owner", in the penal sum of

_____

Dollars ($)

in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

The condition of this obligation is such that whereas, the Principal entered into a certain Contract with the Owner, dated the ____ day of _____, 20_____, a copy of which is hereto attached and made a part hereof for the construction of Contract No. 2014-Phase 1, Samoset Street Sewer System Expansion, Plymouth, Massachusetts.

Now, therefore, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said Contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety and during the one year guaranty period, 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 reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void, otherwise to remain in full force and effect.

Provided, further, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the Contract Documents 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 Contract Documents.

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

In witness whereof, this instrument is executed in six (6) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20_____.

_____	(SEAL)
Principal	Attest:
By: _____	By:_____
Contractor	Witness as to Principal
_____	_____
Name	Name
_____	_____
Street Address	Street Address
_____	_____
City/Town, State, Zip Code	City/Town, State, Zip Code
_____	(SEAL)
Surety	Attest:
By: _____	By:_____
Attorney-in-Fact	Witness as to Surety
_____	_____
Name	Name
_____	_____
Street Address	Street Address
_____	_____
City/Town, State, Zip Code	City/Town, State, Zip Code

Notes:

1. Date of Bond must not be prior to date of Contract. If Contractor is Partnership, all partners must execute the Bond.
2. Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the Project is located.

END OF DOCUMENT

DOCUMENT 00610

PERFORMANCE BOND

Know all men by these presents that

_____

(Name of Contractor)

_____

(Address of Contractor)

a _____, hereinafter called Principal, and

(Corporation, Partnership or Individual)

_____

(Name of Surety)

_____

(Address of Surety)

hereinafter called Surety, are held and firmly bound unto the Town of Plymouth Massachusetts, acting by and through its Procurement Division, hereinafter called "Owner", in the penal sum of

_____

Dollars ($)

in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

The condition of this obligation is such that whereas, the Principal entered into a certain Contract with the Owner, dated the ____ day of _____, 20_____, a copy of which is hereto attached and made a part hereof for the construction of Contract No. 2014-Phase 1, Samoset Street Sewer System Expansion, Plymouth, Massachusetts.

Now, therefore, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said Contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety and during the one year guaranty period, 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 reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void, otherwise to remain in full force and effect.

Provided, further, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the Contract Documents 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 Contract Documents.

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

In witness whereof, this instrument is executed in six (6) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20_____.

_____ (SEAL)	
Principal	Attest:
By: _____	By: _____
Contractor	Witness as to Principal
_____	_____
Name	Name
_____	_____
Street Address	Street Address
_____	_____
City/Town, State, Zip Code	City/Town, State, Zip Code
_____ (SEAL)	
Surety	Attest:
By: _____	By: _____
Attorney-in-Fact	Witness as to Surety
_____	_____
Name	Name
_____	_____
Street Address	Street Address
_____	_____
City/Town, State, Zip Code	City/Town, State, Zip Code

Notes:

1. Date of Bond must not be prior to date of Contract. If Contractor is Partnership, all partners must execute the Bond.
2. Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the Project is located.

END OF DOCUMENT

DOCUMENT 00650

NOTICE TO PROCEED

To: _____ Date: _____

_____

_____ Project: Contract No. 2014-Phase 1

Title: Samoset Street Sewer System Expansion

You are hereby notified to commence Work in accordance with the Agreement dated

_____, 20_____, on or before_____, 20_____

and you are to complete the Work within 260 consecutive calendar days using no more than 185 working days. The date of Completion of all Work is therefore_____, _____.

Owner: Town of Plymouth

By its Procurement Division

By: _____

Pamela D. Hager

Title: Procurement Officer

Acceptance of Notice to Proceed:

Receipt of the above Notice to Proceed is hereby acknowledged

by _____,

this _____ day of _____, _____

By: _____

(Authorized Signature)

Title: _____

END OF DOCUMENT

DOCUMENT 00700

GENERAL CONDITIONS

1. Definitions
2. General Provisions
3. Additional Instructions and Detail Drawings
4. Schedules, Reports and Records
5. Drawings and Specifications
6. Shop Drawings
7. Materials, Services and Facilities
8. Inspection and Testing
9. Substitutions
10. Patents
11. Surveys, Permits, Regulations
12. Protection of Work, Property, Persons
13. Supervision by Contractor
14. Changes in the Work
15. Changes in Contract Price
16. Time for Completion and Liquidated Damages
17. Correction of Work
18. Subsurface Conditions
19. Suspension of Work, Termination and Delay
20. Payments to Contractor
21. Acceptance of Final Payment as Release
22. Insurance
23. Contract Security
24. Assignments
25. Indemnification
26. Separate Contracts
27. Subcontracting
28. Engineer's Authority
29. Land and Rights-of-Way
30. Guaranty
31. Claims and Disputes
32. Mediation and Arbitration
33. Taxes
34. Interpretation of Drawings and Specifications
35. Site Regulations
36. Limitations of Data Presented
37. Health and Safety Equipment
38. Initial Supplies
39. Construction by Owner or Other Contractors
40. Miscellaneous

1. DEFINITIONS

Wherever used in the CONTRACT DOCUMENTS, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:

1.1 ADDENDUM - A written or graphic instrument issued prior to the execution of the CONTRACT, which modifies or interprets the CONTRACT DOCUMENTS, and/or DRAWINGS and SPECIFICATIONS, by additions, deletions, clarifications or corrections.

1.2 AWARDING AUTHORITY - The authorized agent or representative of the OWNER, as defined herein, for which the PROJECT shall be undertaken.

1.3 BID - The offer or proposal of the BIDDER submitted on the prescribed form setting forth the prices for the WORK to be performed.

1.4 BIDDER - Any person, firm or corporation submitting a BID for the WORK.

1.5 BOND - Bid, Performance and Payment Bond(s) and other instruments of security, furnished by the CONTRACTOR and its Surety in accordance with the CONTRACT DOCUMENTS.

1.6 CHANGE ORDER - A written order to the CONTRACTOR authorizing an addition, deletion or revision in the WORK within the general scope of the CONTRACT DOCUMENTS, or authorizing an adjustment in the CONTRACT PRICE or CONTRACT TIME.

1.7 COMPLETION - That date, as certified by the ENGINEER, when the construction of the PROJECT (and all parts thereof) is fully completed in accordance with the CONTRACT DOCUMENTS, including but not limited to the satisfactory fulfillment of, in the opinion of the ENGINEER, all punch list items, correction of any defective WORK, start-up and training, testing of equipment, submission and approval of operations and maintenance manuals and record drawings. Should the CONTRACTOR not achieve COMPLETION within the specified time, or extension of time granted by the OWNER, then the provisions of LIQUIDATED DAMAGES shall apply.

1.8 CONTRACT – The CONTRACT DOCUMENTS form the CONTRACT for construction. The CONTRACT represents the entire and integrated agreement between the OWNER and the CONTRACTOR and supersedes prior negotiations, representations or agreements, either written or oral.

1.09 CONTRACT DOCUMENTS – The term, CONTRACT DOCUMENTS, is defined in the FORM FOR AGREEMENT.

1.10 CONTRACT PRICE - The total monies payable to the CONTRACTOR under the terms and conditions of the CONTRACT DOCUMENTS.

1.11 CONTRACT TIME - The number of calendar days, and/or in combination with working days, stated in the CONTRACT DOCUMENTS to achieve COMPLETION of the WORK.

1.12 CONTRACTOR - The person, firm or corporation with whom the OWNER has executed the CONTRACT.

1.13 DRAWINGS - The part of the CONTRACT DOCUMENTS that shows the characteristics and scope of the WORK to be performed and which have been prepared or approved by the ENGINEER.

1.14 ENGINEER - The person, firm or corporation named as such in the CONTRACT DOCUMENTS.

1.15 FIELD ORDER - A written order affecting a change in the WORK, not involving an adjustment in the CONTRACT PRICE or an extension of the CONTRACT TIME, issued by the ENGINEER to the CONTRACTOR during construction.

1.16 LIQUIDATED DAMAGES – The sum of monies due the OWNER from the CONTRACTOR for the OWNER’s costs incurred because of the CONTRACTOR’s default for failure to achieve SUBSTANTIAL COMPLETION or COMPLETION of the WORK within the specified time(s) or extension of time(s) granted by the OWNER, as specified in the CONTRACT DOCUMENTS.

1.17 NOTICE OF AWARD - The written notice of the acceptance of the BID by the OWNER to the successful BIDDER.

1.18 NOTICE TO PROCEED - Written communication issued by the OWNER to the CONTRACTOR authorizing the CONTRACTOR to proceed with the WORK and establishing the dates of commencement and completion of the WORK.

1.19 OWNER - A public or quasi-public body or authority, corporation, association, partnership, or individual for whom the WORK is to be performed.

1.20 PROJECT - The undertaking to be performed as provided in the CONTRACT DOCUMENTS.

1.21 RESIDENT PROJECT REPRESENTATIVE - The authorized representative of the ENGINEER at the PROJECT site(s) who is assigned to the PROJECT site(s) or any part thereof.

1.22 SHOP DRAWINGS - All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the CONTRACTOR, a SUBCONTRACTOR, manufacturer, SUPPLIER or distributor, which illustrate how specific portions of the WORK shall be fabricated and/or installed.

1.23 SPECIFICATIONS - The part of the CONTRACT DOCUMENTS consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

1.24 STATE - The STATE in which the WORK under this CONTRACT is to be performed.

1.25 SUBCONTRACTOR - A person, firm or corporation having a direct contract with the CONTRACTOR, or with any other SUBCONTRACTOR, for the performance of a part of the WORK.

1.26 SUBSTANTIAL COMPLETION - That date, as certified by the ENGINEER, and in accordance with M.G.L. c.30, §39K, when the construction of the PROJECT, or a specified part thereof, is sufficiently completed in accordance with the CONTRACT DOCUMENTS, so that the PROJECT or specified part can be utilized for the purposes for which it is intended.

1.27 SUPPLEMENTAL GENERAL CONDITIONS - Modifications to GENERAL CONDITIONS required by an entity having a jurisdiction over or for participation, whether financially or otherwise, in the PROJECT and approved by the entity in writing prior to inclusion in the CONTRACT DOCUMENTS, or such requirements that may be imposed by the OWNER, the ENGINEER or applicable federal, state and local laws, regulations and/or agency guidelines.

1.28 SUPPLIER - Any person or organization who supplies materials or equipment to be incorporated with the WORK, including that fabricated to a special design, but who does not perform labor at the site(s).

1.29 WORK - All labor, materials and equipment incorporated or to be incorporated in the PROJECT required by the CONTRACT DOCUMENTS.

1.30 WRITTEN NOTICE - Any notice to any party of the CONTRACT relative to any part of the WORK of the CONTRACT DOCUMENTS in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at its last given address or delivered in person to said party or its authorized representative. Whenever the words "as directed", "as permitted", "as required", or words of like effect are used, it shall be understood that the direction, permission or requirements of the ENGINEER is intended; and similarly, the words "approved", "acceptable", "satisfactory", or words of like import, shall mean approved or acceptable or satisfactory to the ENGINEER. Whenever

the words "or equal", or words of like import are used, it shall be understood that this means equal in accordance with the following provisions: an item shall be considered equal, if in the opinion of the ENGINEER (l) 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 WORK being contracted for or the material being purchased; and (3) it conforms substantially, even with deviations, to the detailed requirements for the item. Whenever any power is possessed by, or act or thing is to be done by the OWNER under this CONTRACT, the exercise of such power or the doing of such act or thing by the AWARDING AUTHORITY shall be a sufficient compliance with the terms of this CONTRACT unless by law some other officer of the OWNER is required to act in the premises. Both the address given in the BID upon which this CONTRACT is founded and the CONTRACTOR's office at or near the site(s) of the WORK are hereby designated as places to either of which notices, letters, and any other communications to the CONTRACTOR shall be certified mailed or delivered. The delivering to the above-named place(s), or depositing in a post-paid wrapper directed to the first named place, in any post office box regularly maintained by the United States Postal Service, of any notice, letter or other communications to the CONTRACTOR, shall be deemed sufficient service thereof upon the CONTRACTOR, and the date of said service shall be the date of such delivery or mailing. The first named address may be changed at any time by an instrument in writing, executed and acknowledged by the CONTRACTOR and delivered to the ENGINEER. Nothing herein contained shall be deemed to preclude or render inoperative the service of any notice, letter or other communication upon the CONTRACTOR personally.

2. GENERAL PROVISIONS

2.1 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 complimentary, and 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 indicated results. All WORK mentioned or indicated in the CONTRACT DOCUMENTS shall be performed by the CONTRACTOR as part of the CONTRACT unless it is specifically indicated in the CONTRACT DOCUMENTS that such WORK is to be done by others.

2.2 In the event of a conflict between any provision or language of the GENERAL CONDITIONS and any provision or language of the CONTRACT DOCUMENTS, the provision or language of the GENERAL CONDITIONS shall control. In the event of any conflict or inconsistency between this CONTRACT and any applicable state law, the applicable statutory provisions shall prevail.

2.3 In the event of conflict in or between the CONTRACT DOCUMENTS, the CONTRACTOR shall be held to the highest standard therein.

2.4 Organization of the SPECIFICATIONS into divisions, sections and articles, and arrangement of DRAWINGS shall not control the CONTRACTOR in dividing the WORK among SUBCONTRACTORS or in establishing the extent of the WORK to be performed by any trade except sections designated for Filed Sub-Bids as otherwise required by law. The CONTRACTOR and all SUBCONTRACTORS shall refer to all of the DRAWINGS, including those showing primarily the work of the mechanical, electrical, and other specialized

trades, and to all of the sections of the specifications, and shall perform all WORK reasonably inferable therefrom as being necessary to produce the indicated results.

2.5 Test boring and soil test information provided in the Project Manual was obtained by the OWNER for use by the ENGINEER in the design of the Project. The OWNER does not hold out such information to the CONTRACTOR as an accurate or approximate indication of subsurface conditions, and no claim for extra cost or extension of time resulting from the CONTRACTOR'S reliance upon such information shall be permitted.

2.6 Execution of the CONTRACT by the CONTRACTOR is a representation that the CONTRACTOR has visited the site, become generally familiar with local conditions under which the WORK is to be performed and correlated personal observations with requirements of the CONTRACT DOCUMENTS. The CONTRACTOR shall thoroughly acquaint himself with all the existing conditions at the site and shall take all such conditions into consideration as they may affect the WORK under this CONTRACT. No allowance will be made in the CONTRACT or the WORK under the CONTRACT for failure of the CONTRACTOR to visit the site.

2.7 Should any omissions, error or conflict be found in the CONTRACT DOCUMENTS, during the bidding period and prior to the times set forth in the INSTRUCTION TO BIDDERS for receipt of such inquiries, the bidders shall request in writing that such conditions be explained by the ENGINEER in the method described therein.

2.8 Should the WORK proceed, after the discovery of errors, conflict, or omissions by the ENGINEER and clarification has not been received from the ENGINEER, the CONTRACTOR will be held fully responsible for replacement or correction of the affected area, as directed by the ENGINEER, at the CONTRACTOR's expense.

2.9 Before ordering any material or doing any WORK, each trade shall verify all measurements at this PROJECT and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of difference between actual dimensions and the measurements indicated on the DRAWINGS, any difference which may be found shall be submitted to the ENGINEER for consideration before proceeding with the WORK.

2.10 Where no explicit quality or standards for material or workmanship are established for work, such work is to be of as good quality of the surrounding work and of the construction of the PROJECT generally.

2.11 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.

3. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

3.1 The CONTRACTOR may be furnished additional instructions and detail DRAWINGS, by the ENGINEER, as necessary to carry out the WORK required by the CONTRACT DOCUMENTS.

3.2 The additional DRAWINGS and instructions thus supplied will become a part of the CONTRACT DOCUMENTS. The CONTRACTOR shall carry out the WORK in accordance with the additional detail DRAWINGS and instructions.

4. SCHEDULES, REPORTS, AND RECORDS

4.1 Within ten (10) days after the WORK has commenced, the CONTRACTOR shall submit to the ENGINEER for approval a progress schedule in satisfactory form, showing in detail its proposed progress for the construction of the various parts of the WORK and the proposed times for receiving the various materials required. The CONTRACTOR shall, at the end of each month, or more often, if required, furnish the ENGINEER two (2) copies of a chart showing actual progress of the various parts of the WORK in comparison with the originally proposed progress schedule, as approved.

4.2 The CONTRACTOR shall submit a schedule of payments that it anticipates it will earn during the course of the WORK.

4.3 The WORK is to commence within ten (10) days after a date to be specified in the NOTICE TO PROCEED unless otherwise specified. WORK shall continue with dispatch to COMPLETION and no suspension of WORK will be allowed without written approval of the ENGINEER.

4.4 Not Used

4.5 Prior to commencing any WORK at the site(s) requiring the presence of the ENGINEER or its representative, the CONTRACTOR shall notify the ENGINEER in writing at least twenty-four (24) hours in advance of the exact date and time on which it intends to start the WORK. In the event that the CONTRACTOR fails to meet this Schedule, the ENGINEER's on-site time will be assessed to the CONTRACTOR and will be deducted from any sums due or which will become due the CONTRACTOR.

4.6 Additional information on work hours can be found in SPECIAL CONDITIONS, Paragraph “WORK HOURS”.

5. DRAWINGS AND SPECIFICATIONS

5.1 The DRAWINGS and SPECIFICATIONS are intended to supplement one another. Materials and workmanship described are not necessarily found in both. DRAWINGS are not intended to be scaled or to act as shop drawings. Inadvertent discrepancies or omissions shown on one drawing but not on others shall not be cause for additional charges or claims.

5.2 The intent of the DRAWINGS and SPECIFICATIONS is to require that the CONTRACTOR shall furnish all labor, materials, tools, equipment, and transportation necessary for proper execution of the WORK in accordance with the CONTRACT DOCUMENTS and all incidental WORK necessary to complete the PROJECT in an acceptable manner, ready for use, occupancy or operation by the OWNER. Any WORK shown on the DRAWINGS, though not mentioned in the SPECIFICATIONS, and any WORK mentioned in the SPECIFICATIONS, though not shown on the DRAWINGS, is to be executed by the CONTRACTOR as a part of the WORK.

5.3 In case of a conflict between the DRAWINGS and SPECIFICATIONS, the SPECIFICATIONS shall govern. Figure dimensions on DRAWINGS shall govern over scaled dimensions, and detail DRAWINGS govern over general DRAWINGS.

5.4 Any discrepancies found between the DRAWINGS and SPECIFICATIONS and site conditions, or any inconsistencies or ambiguities in the DRAWINGS or SPECIFICATIONS, shall be immediately reported to the ENGINEER, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. WORK done by the CONTRACTOR after discovery of such discrepancies, inconsistencies or ambiguities shall be done at the CONTRACTOR's risk.

5.5 Where compliance with two (2) or more industry standards or sets of requirements is indicated, and overlapping of those different standards or requirements establishes two (2) different or conflicting minimums or levels of quality, or quantity, the most stringent requirement (which is generally recognized to be, also, the most costly) is intended and will be enforced, unless specifically detailed language written into the CONTRACT DOCUMENTS (not by way of reference to an industry standard) clearly indicates that the less stringent requirement is to be fulfilled. Refer apparently-equal-but-different requirements, and uncertainties as to which levels of quality or quantity is the more stringent, to the ENGINEER for a written decision before proceeding.

5.6 Whenever an item is specified and/or shown on the DRAWINGS by details or reference, it shall be considered typical for other items which are obviously intended to be the same even though not so designated or specifically named but do serve the same function for this PROJECT.

5.7 Where the terms “necessary,” “as directed,” “when directed,” “satisfactory,” “good and sufficient,” “approved,” or other general qualifying terms are used on the DRAWINGS, they are deemed to be followed by the words ‘in the opinion of the ENGINEER’ or ‘by the ENGINEER’ as the case may be.

5.8 The terms “approval,” “approved,” “approved equal,” “or equal,” or “other approved” mean as approved by the ENGINEER.

5.9 Where reference is made to ASTM Specifications, it shall mean the standard specific specifications of the American Society for Testing and Materials of the most recent designation.

5.10 Any material specified by reference to the number, symbol, or title of a specific standard, such as a Commercial Standard, a Federal Specification, a trade association standard, or other similar standard, shall comply with the requirements in the latest revision thereof and any amendment or supplement thereto in effect on the date indicated on the specifications, except as limited, or modified in such reference. Where compliance with 2 or more industry standards or set of requirements is specified, and overlapping of those different standards or requirements established different or conflicting minimums or level of quality, the most stringent requirements is intended.

5.11 The standards referred to, except as modified in the CONTRACT DOCUMENTS, shall have full force and effect as though printed in the CONTRACT DOCUMENTS. These standards are not furnished to the CONTRACTOR for the reason that the manufacturers and trades involved are assumed to be familiar with their requirements. The CONTRACTOR shall make himself aware of the contents of such documents and furnish the field office with one full set of each.

5.12 Where codes, requirements, and publications of public and private bodies are referred to in the CONTRACT DOCUMENTS, references shall be understood to be the latest revision prior to the date of receiving bids, except where otherwise indicated.

5.13 Mechanical and Electrical Drawings are diagrammatic only, and are not intended to show the exact physical locations or configurations of WORK. Such WORK shall be installed to clear all obstructions, permit proper clearances for the work of other trades, and present an orderly appearance where exposed. Exact location of fixtures and outlets shall be obtained from the ENGINEER before the WORK is roughed in; work installed without such information from the ENGINEER shall be relocated at the CONTRACTOR’s expense.

6. SHOP DRAWINGS

6.1 The CONTRACTOR shall provide SHOP DRAWINGS, as may be necessary for prosecution of the WORK, as required by the CONTRACT DOCUMENTS. The ENGINEER shall promptly review all SHOP DRAWINGS. The ENGINEER's approval of any SHOP DRAWING shall not release the CONTRACTOR from its responsibility for deviations from the CONTRACT DOCUMENTS. A CHANGE ORDER shall evidence the approval of any SHOP DRAWING, which substantially deviates from the requirements of the CONTRACT DOCUMENTS.

6.2 By approving and submitting SHOP DRAWINGS, product data, samples, and similar submittals the CONTRACTOR thereby represents that the CONTRACTOR has determined and verified all dimensions, qualities, quantities, field dimensions, relations to existing work, coordination with work to be installed later, coordination with information on previously accepted SHOP DRAWINGS, product data, samples, or similar submittals and verification of compliance with all the requirements of the CONTRACT DOCUMENT. The accuracy of all such information is the responsibility of the CONTRACTOR. In reviewing SHOP DRAWINGS, product data, samples, or similar submittals the ENGINEER shall be entitled to rely upon the CONTRACTOR’s representation that such information is correct and accurate.

6.3 The CONTRACTOR shall verify all field measurements at the building. Measurements available prior to submittal of SHOP DRAWINGS shall be shown and so noted on submittal. Measurements not available prior to submission of the SHOP DRAWINGS and Product Data shall be so noted on submittal and obtained as soon as available, in all cases prior to fabrication.

6.4 Portions of the WORK requiring a SHOP DRAWING or sample submission shall not begin until the ENGINEER has approved the SHOP DRAWING or submission. A copy of each approved SHOP DRAWING and each approved sample shall be kept in good order by the CONTRACTOR at the site(s) and shall be available to the ENGINEER.

6.5 The CONTRACTOR shall submit to the ENGINEER, before any shop work is commenced, four (4) to seven (7) prints [four (4) prints are to be used by the ENGINEER and up to three (3) prints are be used by the CONTRACTOR] of SHOP DRAWINGS for all items so stated in the SPECIFICATIONS as requiring SHOP DRAWINGS. Additional prints for regulatory agencies shall be submitted when indicated in the SPECIFICATIONS. Standard forms for processing SHOP DRAWINGS will be used by the CONTRACTOR and furnished to the CONTRACTOR by the ENGINEER.

6.5.1 No SHOP DRAWINGS shall be submitted directly by the SUBCONTRACTORS' or SUPPLIERS. All SHOP DRAWINGS shall be submitted through the CONTRACTOR who shall check and verify all field dimensions, check for compliance with the CONTRACT DOCUMENTS, stamp and endorse all SHOP DRAWINGS to indicate its approval and compliance with the above, and assign a transmittal number to each submission. Numbers shall be assigned in sequence. In the event that a SHOP DRAWING is returned marked "Amend and Resubmit" or "Rejected", subsequent resubmittals for the same item shall retain the same transmittal number, but shall have an alphabetical suffix (3a, 3b, etc.). At the time of each submission, the CONTRACTOR shall in writing call the ENGINEER's attention to any deviations to the CONTRACT DOCUMENTS.

6.5.2 No portion of the WORK requiring a SHOP DRAWING shall be commenced until the SHOP DRAWING has been reviewed by the ENGINEER. If the first submittal of the SHOP DRAWING is marked "No Exceptions Taken", "Make Corrections Noted" or "No Action/No Review", up to three (3) prints will be returned to the CONTRACTOR and fabrication of the item may begin. If the SHOP DRAWINGS are marked "Amend and Resubmit" or "Rejected - See Remarks", up to two (2) prints will be returned to the CONTRACTOR with notations thereon of corrections required. The CONTRACTOR shall cause the necessary corrections to be made and shall resubmit [four (4) to seven (7) prints (four (4) prints for the ENGINEER and up to three (3) prints for the CONTRACTOR] with transmittal numbers and letters, as defined above. If subsequent resubmittals are still not acceptable, resubmittals shall be made under the procedure outlined above until final acceptance is received.

6.5.3 The ENGINEER will review SHOP DRAWINGS with reasonable promptness, but its review shall be only for conformance with the design concept of the PROJECT and for compliance with the information given in the CONTRACT DOCUMENTS. The acceptance of the separate item, as such, will not indicate acceptance of the assembly in which the item functions. The CONTRACTOR shall make any corrections required by the ENGINEER and shall return the required number of corrected copies. The CONTRACTOR shall direct specific attention in writing or on resubmitted SHOP DRAWINGS to revisions other than the corrections called for by the ENGINEER on previous submissions.

6.5.4 The ENGINEER's review of SHOP DRAWINGS shall not relieve the CONTRACTOR from its responsibility for any deviations from the requirements of the CONTRACT DOCUMENTS unless the CONTRACTOR has in writing called the ENGINEER's attention to such deviations at the time of submission and the ENGINEER has given written acceptance to the specific deviation, nor shall any acceptance by the ENGINEER relieve the CONTRACTOR from responsibility for errors or omissions in the SHOP DRAWINGS. The final acceptance of SHOP

DRAWINGS by the ENGINEER shall not operate to relieve the CONTRACTOR in any way of its responsibility under this CONTRACT for the satisfactory COMPLETION of the WORK, or for the accuracy of the dimensions, details, and quantities or for its CONTRACT. No change shall be made in the accepted SHOP DRAWINGS without written consent of the ENGINEER. The CONTRACT PRICE shall include the cost of furnishing all SHOP DRAWINGS, and the CONTRACTOR shall be allowed no extra compensation therefor.

6.6 The CONTRACTOR shall submit to the ENGINEER for review, with such promptness as to cause no delay in the WORK, all samples required by the CONTRACT DOCUMENTS. All samples shall be checked by and stamped with the approval of the CONTRACTOR, identified clearly as to material, manufacturer, any pertinent catalog numbers, the use for which intended, and the section number and paragraph of the SPECIFICATION wherein the material is specified. All samples shall be shipped post and/or freight paid.

6.6.1 At the time of each submission, the CONTRACTOR shall in writing, call the ENGINEER's attention to the deviations that the samples may have from the requirements of the CONTRACT DOCUMENTS.

6.6.2 The ENGINEER will review with reasonable promptness submitted samples, but its review shall be only for conformance with the information given in the CONTRACT DOCUMENTS. The acceptance of a separate item as such will not indicate acceptance of the assembly in which the item functions. In the event samples are not accepted, the CONTRACTOR shall resubmit new samples until acceptance is obtained.

6.6.3 No WORK requiring sample submission shall be commenced until the ENGINEER has accepted the submission in writing.

6.6.4 The ENGINEER's acceptance of sample(s) shall not relieve the CONTRACTOR from its responsibility for any deviations from the requirements of the CONTRACT DOCUMENTS unless the CONTRACTOR has in writing called the ENGINEER's attention to such deviations at the time of submission and the ENGINEER has given written acceptance of the specific deviations.

6.7 A maximum of two submissions of each shop drawing will be reviewed, checked and commented upon by the ENGINEER without charge to the CONTRACTOR. Any additional submissions which are ordered by the ENGINEER to fulfill the stipulations of the CONTRACT DOCUMENTS, or to make modifications and/or corrections order by the ENGINEER in the review of the first two shop drawings submittals will be reviewed and checked and commented upon by the ENGINEER. However, the cost for such subsequence reviews (based upon the ENGINEER’s documentation of time and materials) will be the sole responsibility of the CONTRACTOR. Such costs will be deducted from the CONTRACTOR’s monthly payment requests.

7. MATERIALS, SERVICES AND FACILITIES

7.1 Not Used.

7.2 Materials and equipment shall be so stored as to insure the preservation of its quality and fitness for the WORK. Stored materials and equipment to be incorporated in the WORK shall be located so as to facilitate prompt inspection.

7.3 Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

7.4 Materials, supplies, and equipment shall be in accordance with samples submitted by the CONTRACTOR and approved by the ENGINEER.

7.5 Not Used.

7.6 All materials are to be new, unused and the best and of finest quality of their several kinds. The CONTRACTOR shall provide facilities and handle all materials as required for the inspection by the ENGINEER. Materials which have not been accepted by the ENGINEER shall be removed from the site(s) of the WORK together with all surplus earth and materials which are unsuitable or not in conformity with the CONTRACT DOCUMENTS. Disposal of materials shall be without expense to the OWNER. The CONTRACTOR shall promptly replace any materials rejected or condemned, and shall not be allowed extra time for COMPLETION of the WORK by reason of such rejection.

7.5 Additional information on Materials, Services, and Facilities can be found in OWNER/CONTRACTOR AGREEMENT.

8. INSPECTION AND TESTING

8.1 Not Used.

8.2 The OWNER shall provide all inspection and testing services not required by the CONTRACT DOCUMENTS.

8.3 The CONTRACTOR shall provide at its expense the testing and inspection services required by the CONTRACT DOCUMENTS.

8.4 If the CONTRACT DOCUMENTS, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any WORK to specifically be inspected, tested, or approved by someone other than the CONTRACTOR, the CONTRACTOR will give the ENGINEER timely notice of readiness. The CONTRACTOR will then furnish the ENGINEER the required certificates of inspection, testing or approval.

8.5 Inspections, tests or approvals by the ENGINEER or others shall not relieve the CONTRACTOR from the obligation to perform the WORK in accordance with the requirements of the CONTRACT DOCUMENTS. Should inspections or tests reveal defective WORK, the defective WORK shall be made good and unsuitable materials shall be rejected, notwithstanding that such WORK and materials have been previously overlooked and accepted or estimated for payment. If the WORK or any part thereof shall be found defective at any time before the final acceptance of the whole WORK, the CONTRACTOR shall forthwith make good such defect in a manner satisfactory to the ENGINEER. Nothing in this CONTRACT shall be construed as vesting in the CONTRACTOR any right or property in the materials used after they have been attached or affixed to the WORK or the soil, but all such materials shall, upon being so attached or affixed, become the property of the OWNER.

8.6 All portions of the WORK condemned by the ENGINEER, as failing to conform to the CONTRACT DOCUMENTS, shall be taken down and removed, and the CONTRACTOR shall promptly replace and re-execute the same in accordance therewith and without expense to the OWNER and bear the expense of making good all WORK or property of other contractors or of the OWNER destroyed or damaged by such removal or replacement.8.7 The ENGINEER and its representatives will at all times have access to the WORK. In addition, authorized representatives and agents of any participating federal or STATE agency shall be permitted to inspect all WORK, materials, payroll records of personnel, invoices of materials, and other relevant data and records. The CONTRACTOR will provide proper facilities for such access and observation of the WORK and, also, for any inspection or testing thereof.

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

8.9 If the ENGINEER considers it necessary or advisable that covered WORK be inspected or tested by others, the CONTRACTOR at the ENGINEER's request, will uncover, expose, or otherwise make available for observation, inspection or testing, as the ENGINEER may require, that portion of the WORK in question, furnishing all necessary labor, materials, tools and equipment. If it is found that such WORK is defective, the CONTRACTOR will bear all expenses of such uncovering, exposure, observation, inspection, and testing and of satisfactory reconstruction. If, however, such WORK is found not to be defective, the CONTRACTOR will be allowed an increase in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, directly attributed to such uncovering, exposure, observation, inspection, testing and reconstruction; and an appropriate CHANGE ORDER shall be issued.

8.10 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, sealed and waxed as specified, 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. At the completion of the WORK and as a condition of SUBSTANTIAL COMPLETION, the CONTRACTOR shall remove all waste materials and rubbish from and about the Project as well as all his tools, construction equipment, machinery and surplus materials, and shall clean all surfaces and leave the work ‘broom clean’ or its equivalent, unless more exactly specified herein and in other sections of these specifications. No burning of rubbish at the job site will be permitted. Provision for removal of rubbish will be made by the CONTRACTOR at no additional cost to the OWNER.

8.11 Additional information on Inspection and Testing can be found in OWNER/CONTRACTOR AGREEMENT.

9. SUBSTITUTIONS

9.1 Not Used.

9.2 Not Used.

9.3 Not Used:

9.4 See GENERAL INFORMATION Special Conditions Paragraph “SUBSTITUTES OF APPROVED ‘OR EQUAL”, and OWNER/CONTRACTOR AGREEMENT.

10. PATENTS

10.1 The CONTRACTOR shall pay all applicable royalties and license fees.

11. SURVEYS, PERMITS, REGULATIONS

11.1 The OWNER shall furnish surveys describing physical characteristics, legal limitations, and utility locations for the site of the PROJECT together with a suitable number of benchmarks adjacent to the WORK, as shown in the CONTRACT DOCUMENTS. The OWNER makes no warranties as to the accuracy or completeness of such material. From the information provided by the OWNER, unless specified in the CONTRACT DOCUMENTS, the CONTRACTOR shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pile locations, and other working points, lines, elevations and cut sheets. The CONTRACTOR shall employ, at its expense, a competent surveyor, registered in the STATE wherein the WORK is to be done to perform such duties.

11.2 Not Used.

11.3 Not Used.

11.4 Additional information on Survey can be found in OWNER/CONTRACTOR AGREEMENT.

12. PROTECTION OF WORK, PROPERTY, AND PERSONS

12.1 The CONTRACTOR will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the WORK. The CONTRACTOR will take all necessary precautions for the safety of, and will provide necessary protection to prevent damage, injury or loss to, all employees on the WORK and other persons who may be affected thereby, all the WORK and all materials or equipment to be incorporated therein, whether in storage on or off the site(s), and other property at the site(s) or adjacent thereto, including trees, shrubs, lawns, walks, pavement, roadways, structures and utilities not designated for removal, relocation or replacement during the course of construction. The CONTRACTOR shall be responsible for and pay for all loss or damage to materials and property, whether such are incorporated in, or to be incorporated in, the WORK. The CONTRACTOR shall also replace or restore to original condition man-made or natural improvements or other things injured or interfered with by the CONTRACTOR in carrying out the WORK. Adequate weather protection of all materials and structures of this PROJECT shall be the duty of the CONTRACTOR.

12.2 The CONTRACTOR will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. It will erect and maintain, as required by the conditions and progress of the WORK, all necessary safeguards for safety and protection. It will notify owners of adjacent utilities when prosecution of the WORK may affect them. The CONTRACTOR will remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by the CONTRACTOR, any SUBCONTRACTOR(s), or anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, except damage or loss attributable to the fault of the CONTRACT DOCUMENTS, or to acts or omissions of 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.

12.3 In emergencies affecting the safety of persons or the WORK or property at the site(s) or adjacent thereto, the CONTRACTOR, without special instruction or authorization from the ENGINEER or OWNER, shall act to prevent threatened damage, injury or loss. The CONTRACTOR will give the ENGINEER prompt written notice of any significant changes in the WORK or deviations from the CONTRACT DOCUMENTS caused thereby, and a CHANGE ORDER shall be issued covering the changes and deviations involved.

12.4 HAZARDOUS MATERIAL

12.4.1. If at any time during construction the presence of unanticipated hazardous materials at or proximate to a construction site(s) is detected, the CONTRACTOR shall stop WORK in the affected area and perform the following immediately:

a. Notify the OWNER in writing.

b. Take all action necessary and appropriate for the protection and safety of the public and persons at or about the site(s), including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

c. Notify the respective STATE agency responsible for hazardous waste and receive instructions as to the appropriate measures to be taken while working in that area.

d. Notify the designated representative of the respective STATE agency having financial, license or permit and/or technical jurisdiction for this PROJECT, or other appropriate STATE program director/administrator in writing mailed within 48 hours following discovery of the suspected hazardous materials.

e. Notify the local hazardous waste coordinator.

12.4.2. Actions at the construction site(s) following completion of these steps shall be at the direction of the STATE agency responsible for hazardous waste. Nothing in this Article shall be construed to require the ENGINEER and/or the CONTRACTOR to perform WORK for which adequate compensation has not been contracted for other than to insure that basic measures necessary to protect the health and welfare of workers, residents and abutters are immediately adopted.

12.4.3. At construction site(s) where the presence of contaminated or hazardous materials are suspected to exist and provisions have been made in the CONTRACT DOCUMENTS for their management, the requirements of Paragraph 12.4.1 of this Article shall apply.

13. SUPERVISION BY CONTRACTOR

13.1 The CONTRACTOR will supervise and direct the WORK. The CONTRACTOR will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The CONTRACTOR will employ and maintain on the WORK a qualified supervisor or superintendent who shall have been designated in writing by the CONTRACTOR as the CONTRACTOR's representative at the site(s). The supervisor/superintendent shall have full authority to act on behalf of the CONTRACTOR, and all communications given to the supervisor/superintendent shall be as binding as if given to the CONTRACTOR. The supervisor/superintendent shall be present on the site(s) at all times, as required, to perform adequate supervision and coordination of the WORK. The CONTRACTOR and each of the subcontractors shall furnish to both the OWNER and the ENGINEER the names, addresses, and telephone numbers of the superintendent and at least two other of the CONTRACTOR’s authorized representatives indicating where they can be contacted at times other than normal working hours in case of emergency.

13.2 The CONTRACTOR shall employ only competent workers; and, whenever the ENGINEER shall notify the CONTRACTOR in writing that any person on the WORK is, in its opinion, incompetent, unfaithful, disorderly or otherwise unsatisfactory or not employed in accordance with the provisions of this CONTRACT, such person shall be discharged from the WORK and shall not again be employed on it except with the consent of the ENGINEER.

13.3 All loss, damage, or liability, or cost of correcting defective work arising from the employment of any construction means, methods, techniques, sequences or procedures shall be born 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 OWNER and ENGINEER in writing that such means, methods, techniques, sequences or procedures are not safe or suitable, and the OWNER has then instructed the CONTRACTOR in writing to proceed at the OWNER’s risk.

13.4 The CONTRACTOR shall be responsible to the OWNER for acts and omissions of all entities or persons performing or supplying the WORK.

13.4.1 The CONTRACTOR shall employ workers competent to perform the WORK required by the contract and, upon written request of the OWNER, remove and replace workers whom the OWNER deems to be disorderly, careless or incompetent, or to be employed in violation of the terms of the CONTRACT DOCUMENTS, at no increase in the CONTRACT PRICE or the CONTRACT TIME.

13.4.2 The CONTRACTOR shall neither permit nor suffer smoking where it creates a hazard, nor the introduction or use of spirituous or intoxicating liquors upon or about the works embraced in this CONTRACT or upon any of the ground occupied by him.

13.5 The CONTRACTOR shall be responsible for inspection of portions of WORK already performed to determine that such portions are in proper condition to receive subsequent WORK.

13.6 The CONTRACTOR represents and warrants that its financial condition is sound and that the CONTRACTOR is capable of performing the work required pursuant to the CONTRACT DOCUMENTS. Upon request by the OWNER, the CONTRACTOR shall make available to the OWNER such audited and unaudited financial statements of the CONTRACTOR as the OWNER may reasonably request. The CONTRACTOR shall promptly advise the OWNER of any occurrence, event, fact, or other matter that has had, will have, or might reasonably be predicted to have a material adverse effect upon the financial condition of the CONTRACTOR.

13.7 The CONTRACTOR shall reimburse the OWNER for costs incurred by the ENGINEER for design and construction administration services which are caused by the CONTRACTOR's inefficient or otherwise faulty administration or execution of its WORK. These may include but are not limited to the cost of the ENGINEER to perform:

13.7.1 Repeated review of the CONTRACTOR's resubmittals, substantially out of sequence from the submittal schedule provided by the CONTRACTOR and agreed to by the ENGINEER.

13.7.2 An extensive number of responses to the CONTRACTOR's requests for information where such information is available to the CONTRACTOR from a careful study and comparison of the CONTRACT DOCUMENTS, field conditions, other Owner-provided information, CONTRACTOR -prepared coordination drawings, or prior Project correspondence or documentation.

13.7.3 An extensive number of Change Orders requiring evaluation of proposals and the preparation or revision of Instruments of Service and not otherwise caused by the design defects of the ENGINEER.

13.7.4 Consultation regarding replacement of WORK resulting from fire or other cause during construction.

13.7.5 Evaluation of an extensive number of claims not otherwise caused by design defect.

13.7.6 Evaluation of substitutions proposed by the CONTRACTOR and making subsequent revisions to Instruments of Services resulting therefrom.

13.7.8 Preparation of design and documentation for alternate bid or proposal requests proposed by the CONTRACTOR.

13.7.9 Contract administration services provided 60 days or more after SUBSTANTIAL COMPLETION.

14. CHANGES IN THE WORK

14.1 The OWNER may at any time, as the need arises, order changes within the scope of the WORK without invalidating the CONTRACT. If such changes increase or decrease the amount due under the CONTRACT DOCUMENTS, or in the time required for performance of the WORK, a CHANGE ORDER shall authorize an equitable adjustment. The OWNER must confirm in writing any explanation or interpretation of DRAWINGS or SPECIFICATIONS altering or varying the WORK, made by an employee of the OWNER, before such changed WORK is acted upon by the CONTRACTOR.

14.2 The ENGINEER, also, may at any time by issuing a FIELD ORDER make changes in the details of the WORK. The CONTRACTOR shall proceed with the performance of any changes in the WORK so ordered by the ENGINEER, unless the CONTRACTOR believes that such FIELD ORDER entitles the CONTRACTOR to a change in the CONTRACT PRICE, or time, or both, in which event the CONTRACTOR shall give the ENGINEER written notice thereof within seven (7) days after receipt of the ordered change. Thereafter, the CONTRACTOR shall document the basis for the change in CONTRACT PRICE or time within thirty (30) days. The CONTRACTOR shall not execute such changes pending receipt of an executed CHANGE ORDER or further instruction from the OWNER.

14.3 All changes in the WORK shall be in accordance with the provisions of M.G.L. c.30, §39I.

14.4 WORK PERFORMED UNDER PROTEST. The CONTRACTOR must perform any work required by the OWNER and if it considers the work to be “extra”, and the OWNER disagrees, the work must be performed under protest.

15. CHANGES IN CONTRACT PRICE

15.1 The CONTRACT PRICE may be changed only by a CHANGE ORDER. The value of any WORK covered by a CHANGE ORDER, or of any claim for increase or decrease in the CONTRACT PRICE, shall be determined by one (1) or more of the following methods in order of precedence listed below:

(a) Unit prices previously approved.

(b) An agreed lump sum.

(c) The actual cost for labor, direct overhead, materials, supplies, equipment and other services necessary to complete the WORK, computed as follows:

(1) The reasonable cost of labor employed directly on the WORK at prevailing rates of wages.

(2) The cost of Worker's Compensation Insurance, Federal Social Security and STATE Unemployment Compensation on Item (l) at established rates.

(3) The reasonable cost of materials incorporated in the WORK.

(4) The reasonable cost at fair market rental rates for equipment employed directly on the WORK.

(5) Five (5) percent of Items (1), (2), (3) and (4) for overhead, superintendence and profit. On subcontract WORK, this five (5) percent will be allowed only to the SUBCONTRACTOR.

(6) An additional five (5) percent of Items (1), (2), (3) and (4) on WORK performed by a SUBCONTRACTOR of the CONTRACTOR. This five (5) percent includes overhead, superintendence, profit and bonds.

(7) No additional costs will be allowed for any lower tier of Subcontractors.

16. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

16.1 Not Used.

16.2 Not Used.

16.3 Not Used.

16.4 Not Used.

16.5 See OWNER/CONTRACTOR AGREEMENT.

17. CORRECTION OF WORK

17.1 Not Used.

17.2 Not Used.

17.3 Not Used.

17.4 See OWNER/CONTRACTOR AGREEMENT.

18. SUBSURFACE CONDITIONS

18.1 Not Used.

18.2 Not Used.

18.3 See OWNER/CONTRACTOR AGREEMENT.

19. SUSPENSION OF WORK, TERMINATION AND DELAY

19.1 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 a written notice from the OWNER to immediately correct such default or neglect within a three-day period. If the CONTRACTOR within such three-day period after receipt of such notice fails to correct any deficiencies, the OWNER may, without prejudice to other remedies the OWNER may have (including Termination in accordance with Article 19), correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the CONTRACTOR the reasonable cost of correcting such deficiencies, including OWNER’s expenses and compensation for the ENGINEER’s

additional services made necessary by such default, neglect or failure. If payments then or thereafter due the CONTRACTOR are not sufficient to cover such amounts, the CONTRACTOR shall pay the difference to the OWNER. In the event that the CONTRACTOR's failure to prosecute the WORK causes (in the opinion of the OWNER), a risk of harm to the public, the OWNER shall have the right to carry out the WORK without notice at the CONTRACTOR's cost and/or deduct such sums from monies due the CONTRACTOR.

19.2 Not Used.

19.3 If the CONTRACTOR is adjudged bankrupt or insolvent, or if the CONTRACTOR makes a general assignment for the benefit of its creditors, or if a trustee or receiver is appointed for the CONTRACTOR or for any of the CONTRACTOR's property, or if the CONTRACTOR files a petition to take advantage of any debtor's act or to reorganize under the bankruptcy or other applicable laws, or if the CONTRACTOR consistently or repeatedly refuses or fails, excepting cases of which extension of time is appropriated, to supply sufficient properly skilled workmen or suitable materials or equipment, or if the CONTRACTOR repeatedly fails to make prompt payments to SUBCONTRACTORs or for labor, materials, or equipment, or if the CONTRACTOR disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the WORK, or if the CONTRACTOR disregards the authority of the ENGINEER, or if the CONTRACTOR otherwise violates any provision of the CONTRACT DOCUMENTS, then the OWNER 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 material intended for the work, wherever stored, and seven (7) days from delivery of such written notice, may terminate the services of the CONTRACTOR accept assignment of any or all SUBCONTRACTOR's contracts, and finish the WORK by whatever method the OWNER may deem expedient. The OWNER shall be entitled to collect from the CONTRACTOR all direct, indirect, consequential damages suffered by the OWNER of behalf of the CONTRACTOR's defaults, including without limitations additional services and expenses of the ENGINEER and Project Manager and the ENGINEER's consultants made necessary thereby. The OWNER shall be entitled to hold all amounts due to CONTRACTOR at the date of termination until all of the OWNER's damages have been established, and to apply such amounts to such damages. The OWNER shall incur no liability by reason of such termination.

19.4 In such case the CONTRACTOR shall not be entitled to receive any further payment until the WORK is completed. If the unpaid balance of the CONTRACT PRICE exceeds the direct and indirect costs of completing the PROJECT, including compensation for additional professional services, such excess shall be paid to the CONTRACTOR. If such costs exceed such unpaid balance, the CONTRACTOR will pay the difference to the OWNER. Such costs incurred by the OWNER will be determined by the ENGINEER and incorporated in a CHANGE ORDER.

19.5 Where the CONTRACTOR's services have been so terminated by the OWNER, said termination shall not affect any right of the OWNER against the CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of monies by the OWNER due the CONTRACTOR will not release the CONTRACTOR from compliance with the CONTRACT DOCUMENTS.

19.6 Not Used.

19.7 The CONTRACTOR hereby agrees that the CONTRACTOR shall have no claim for damages of any kind against the OWNER or the ENGINEER on account of any delay in the commencement of the WORK and/or any hindrance delay or suspension of any portion of the WORK, whether such delay is caused by the OWNER, the ARCHITECT, or otherwise, except as and to the extent expressly provided under M.G.L. c.30, §39O. The CONTRACTOR acknowledges that the CONTRACTOR's sole remedy for any such delay and/or suspension will be an extension of time provided the CONTRACTOR complies with notice requirements contained in Paragraph 31.3.

19.8 No extension of time shall be granted because of seasonal, normal 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. Any additional cost of operations or conditions resulting therefrom shall be the responsibility of the CONTRACTOR.

19.9 Claims relating to time shall be made in accordance with applicable provisions of Paragraph 31.3.

19.10 Additional information on Suspension of work, Termination and Delay can be found in OWNER/CONTRACOTR AGREEMENT.

20. PAYMENTS TO CONTRACTOR

20.1 Not Used.

20.1.1 Each Application for Payment or periodic estimate requesting payment shall be accompanied by a certificate signed by each SUBCONTRACTOR under pains and penalties of perjury 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 OWNER through the ENGINEER. Such waiver or certificate shall be in a form acceptable to the OWNER. The CONTRACTOR warrants that title to all work covered by an application for payment will pass to the OWNER either by incorporation into the construction or upon the receipt of payment by the CONTRACTOR, whichever occurs first, free and clear of all liens, claims, security interests, or encumbrances, hereinafter referred to in this article as 'liens.' The CONTRACTOR further agrees that the submission of any application for payment shall conclusively be deemed to waive all liens with respect to set 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.

20.1.2 Each application for payment must be accompanied by a payment affidavit, Form AIA G706 unless directed otherwise, properly sworn to and signed by a responsible officer of the CONTRACTOR's firm, stating that all bills for materials and all wages for work performed upon the work of the CONTRACT have been paid in full.

20.1.3 Payment to subcontractors shall be made in accordance with M.G.L. c. 30, § 39F, which is incorporated by reference herein.

20.2 Prior to SUBSTANTIAL COMPLETION, the OWNER with the approval of the ENGINEER and with the concurrence of the CONTRACTOR, may use any substantially completed portions of the WORK. Such use shall not constitute an acceptance of such portions of the WORK.

20.3 The OWNER shall have the right to enter the premises for the purpose of doing WORK not covered by the CONTRACT DOCUMENTS. This provision shall not be construed as relieving the CONTRACTOR of the sole responsibility for the care and protection of the WORK, or the restoration of any damaged WORK except such as may be caused by agents or employees of the OWNER.

20.4 The CONTRACTOR will indemnify and save the OWNER or the OWNER's agents harmless from all claims growing out of the lawful demands of SUBCONTRACTORs, laborers, workmen, mechanics, materialmen and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of WORK. The CONTRACTOR shall at the OWNER's request furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived.

20.5 Until SUBSTANTIAL COMPLETION of the entire project, the OWNER will pay ninety-five percent (95%) of the amount due the CONTRACTOR on account of progress payments. This retainage of five percent (5%), less any amount due from the CONTRACTOR for LIQUIDATED DAMAGES and applicable costs of the ENGINEER and ENGINEER's consultants and less amounts based on the established value of punch list items and any other OWNER claims or back-charges against the CONTRACTOR, will be paid within sixty-five (65) days of SUBSTANTIAL COMPLETION in accordance with M.G.L. c.30, §39K.

20.6 The CONTRACTOR warrants that title to all WORK (including materials and equipment) covered by an Application for Payment will pass to the OWNER either by incorporation in the WORK or upon the receipt of payment by the CONTRACTOR, whichever occurs first, free and clear of all liens, claims, security interests or encumbrances.

20.7 PUNCH LIST MANAGEMENT. Prior to SUBSTANTIAL COMPLETION, the CONTRACTOR shall develop a list of work to be completed or corrected by room and trade. Post individual items in a visible location in every room for trade sign off of completed items. The punch list is to be complied with and in a process of active completion at the time of SUBSTANTIAL COMPLETION, prior to the de-mobilization of major subcontractors. Amend the punch list with OWNER furnished items during the 60-day period prior to Final Completion. Submit the punch list to the ENGINEER for amendment. Indicate completion dates of items, and submit completed list prior to final release of retainage.

20.8 Prior to requesting SUBSTANTIAL COMPLETION, the CONTRACTOR shall submit written certification that:

20.8.1 Equipment and systems have been tested in the presence of the OWNER's Representative and are operational.

20.8.2 OWNER's designated staff have bee instructed on all equipment and systems and an OWNER signed receipt has been furnished to the ENGINEER.

20.8.3 Operational and Maintenance Manuals and record drawings have been submitted to and reviewed by the ENGINEER and have been delivered to the OWNER with required corrections. Submit copies of receipts signed by OWNER's representative.

20.8.4 OWNER has received the specified guarantees and spare parts and the OWNER has signed a receipt for same.

20.8.5 Project has been completed and is ready for final inspection and an appropriate Certificate of Occupancy has been issued.

The CONTRACTOR shall also submit the following:

a. AIA G706 – Contractor's Affidavit of Payments for Debts and Claims

b. AIA G706A – Contractor's Affidavit of Release of Liens

c. AIA G707 – Consent of Surety to Final Payment

d. Maintenance Guarantee

20.9 Prior to requesting final inspection, the CONTRACTOR shall submit written certification that:

a. Work has been completed in accordance with CONTRACT DOCUMENTS.

b. Project has been inspected for compliance with CONTRACT DOCUMENTS.

If the ENGINEER does not consider the work finally complete, the CONTRACTOR will be notified, in writing, with the reasons stated. The CONTRACTOR will take immediate steps to correct the stated deficiencies and then submit a second written certification to the ENGINEER.

20.10 Re-inspection Costs: Should the ENGINEER be required to reinspect the work because of failure of the CONTRACTOR to comply with the certification listed in 20.9, the ENGINEER will bill the OWNER for all related cost incurred, such cost will be deducted from the CONTRACTOR's payment.

20.11 Additional information on Payments to Contractor can be found in OWNER/CONTRACTOR AGREEMENT.

21. ACCEPTANCE OF FINAL PAYMENT AS RELEASE

21.1 Not Used.

21.2 See OWNER/CONTRACTOR AGREEMENT.

22. INSURANCE

22.1 Not Used.

22.2 Not Used.

22.3 Not Used.

22.4 Not Used.

22.5 Not Used.

22.6 Not Used.

22.7 Not Used.

22.8 Not Used.

22.9 Not Used.

22.10 The CONTRACTOR's Public Liability Insurance shall provide, by any necessary removal of exclusions or by separate policies of the same limits, coverage for all hazards inherent in the WORK of this PROJECT. Without limiting the foregoing statement, the insurance shall cover the following hazards: Explosion, collapse and underground damage; damage to property in the CONTRACTOR's care, custody or control; rigging, hoisting and moving.

22.11 The CONTRACTOR shall acquire and maintain, Fire and Extended Coverage Insurance upon the PROJECT to the full insurable value thereof for the benefit of the OWNER, the CONTRACTOR and SUBCONTRACTORs as their interest may appear. This provision shall in no way release the CONTRACTOR or CONTRACTOR's surety from obligations under the CONTRACT DOCUMENTS to fully complete the PROJECT.

22.12 For more information on Insurance see GENERAL INFORMATION, and OWNER/CONTRACTOR AGREEMENT.

23. CONTRACT SECURITY

23.1 The CONTRACTOR shall within ten (10) days after receipt of the NOTICE OF AWARD furnish the OWNER with a performance bond and payment bond in penal sums equal to the full amount of the CONTRACT PRICE, conditioned upon the performance by the CONTRACTOR of all undertakings, covenants, terms, conditions, and agreements of the CONTRACT DOCUMENTS and upon prompt payment by the CONTRACTOR to all persons supplying labor and materials in the prosecution of the WORK provided by the CONTRACT DOCUMENTS. Such bonds shall be executed by the CONTRACTOR and a corporate bonding company licensed to transact such business in the STATE in which the WORK is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds", as published in the U.S. Treasury Department Circular Number 570. These bonds shall (a) guarantee the faithful performance by the CONTRACTOR of all its obligations under this contract and (b) constitute the security required by M.G.L. c. 149, § 29 and c. 30, § 39A, as amended, for payment by the CONTRACTOR or its subcontractors used or employed in connection with the contract. Each bond shall incorporate by reference the terms of this CONTRACT. These bonds shall remain in effect for the entire guarantee period for each phase of the WORK, which shall commence on the date of SUBSTANTIAL COMPLETION. The expense of these bonds shall be borne by the CONTRACTOR. If at any time a surety on any such bonds is declared bankrupt or loses its right to do business in the STATE in which the WORK is to be performed or is removed from the list of Surety Companies Acceptable on Federal Bonds, the CONTRACTOR shall, within ten (10) days substitute an acceptable

bond(s) in such form and sum and signed by such other surety or sureties as may be satisfactory to the OWNER. The premiums on such bond(s) shall be paid by the CONTRACTOR. No further payments to the CONTRACTOR shall be deemed due nor shall any be made until the new surety or sureties shall have furnished an acceptable bond(s) to the OWNER.

23.2 If the surety on any bond furnished by the CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in Massachusetts, the CONTRACTOR shall within 20 days thereafter substitute another bond due until the new surety or sureties have furnished an acceptable bond to the OWNER.

24. ASSIGNMENTS

24.1 Not Used.

24.2 See OWNER/CONTRACTOR AGREEMENT.

25. INDEMNIFICATION

25.1 Not Used.

25.2 In any and all claims against the OWNER or the ENGINEER, or any of its 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 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 Worker's Compensation Acts, Disability Benefit Acts, or other employee benefit acts.

25.3. The CONTRACTOR shall bear all loses resulting from the use or storage of explosives and highly inflammable materials and shall indemnify, defend and save harmless the OWNER and all of its officers, agents, and employees from all suits, damages, claims, liabilities or judgments for bodily injuries or death to any person and for property damage or damage destruction arising out of the use or storage of explosives and highly inflammable materials.

25.4 The CONTRACTOR further covenants to indemnify, defend and hold harmless the OWNER, its officers, agents, and employees from and against each and every demand, claim, judgment or liability for or on account of the use of any patented invention, article or appliance included in the materials and equipment agreed to be furnished, supplied or used under this contract.

25.5 The obligation of the CONTRACTOR under this Article shall not extend to the liability of the ENGINEER, its agents or employees, arising out of the preparation or approval of maps, DRAWINGS, opinions, reports, surveys, CHANGE ORDERs, designs or SPECIFICATIONS.

25.6 The CONTRACTOR will indemnify and save the OWNER or the OWNER's agents harmless from all claims growing out of the lawful demands of SUBCONTRACTORs, laborers, workmen, mechanics, materialmen, and furnisher of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the WORK. The CONTRACTOR shall, at the OWNER's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived.

25.6 For additional information on Indemnification, see OWNER/CONTRACTOR AGREEMENT.

26. SEPARATE CONTRACTS

26.1 The OWNER reserves the right to let other contracts in connection with this PROJECT. The CONTRACTOR shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their WORK, and shall promptly connect and coordinate WORK with theirs. If the proper execution or results of any part of the CONTRACTOR's WORK depends upon the WORK of any other contractor, the CONTRACTOR shall inspect and promptly report to the ENGINEER any defects in such WORK that render it unsuitable for such proper execution and results.

26.2 The OWNER may perform additional WORK related to the PROJECT or let other contracts containing provisions similar to these. The CONTRACTOR will afford the other contractors who are parties to such contracts (or the OWNER, if performing the additional WORK itself) reasonable opportunity for the introduction and storage of materials and equipment, and the execution of WORK, and shall properly connect and coordinate WORK with theirs.

26.3 If the performance of additional WORK by other contractors or the OWNER is not noted in the CONTRACT DOCUMENTS prior to the execution of the CONTRACT, written notice thereof shall be given to the CONTRACTOR prior to starting any such additional WORK. If the CONTRACTOR believes that the performance of such additional WORK by the OWNER or others involves the CONTRACTOR in additional expense, or entitles the CONTRACTOR to an extension of the CONTRACT TIME, the CONTRACTOR may make a claim therefor, as provided in Articles 15 and 16.

26.4 The OWNER shall have the right to enter the premises for the purpose of doing WORK not covered by the CONTRACT DOCUMENTS. This provision shall not be construed as relieving the CONTRACTOR of the sole responsibility for the care and protection of the WORK, or the restoration of any damaged WORK except such as may be caused by agents or employees of the OWNER.

27. SUBCONTRACTING

27.1 The CONTRACTOR may utilize the services of specialty SUBCONTRACTORs on those parts of the WORK, which under normal contracting practices are performed, by specialty SUBCONTRACTORs. The CONTRACTOR, as soon as practicable after award of the CONTRACT, shall furnish in writing to the OWNER and the ENGINEER the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the WORK. The ENGINEER will promptly reply to the CONTRACTOR stating whether or not the OWNER or the ENGINEER, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the OWNER or ENGINEER to reply promptly shall constitute notice of no reasonable objection.

27.1.1 The CONTRACTOR shall not contract with a proposed person or entity to whom the OWNER or ENGINEER has made reasonable and timely objection. The CONTRACTOR shall not be required to contract with anyone to whom the CONTRACTOR has made a reasonable objection.

27.1.2 If the OWNER or ENGINEER has reasonable objection to a person or entity proposed by the CONTRACTOR, the CONTRACTOR shall propose another to whom the OWNER or ARCHITECT has no reasonable objection. If the proposed but rejected SUBCONTRACTOR was reasonably capable of performing the WORK, the CONTRACT PRICE and CONTRACT TIME shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate CHANGE ORDER shall be issued before commencement of the substitute SUCBONTRACTOR's WORK. However, no increase in the CONTRACT PRICE or CONTRACT TIME shall be allowed for such change unless the CONTRACTOR has acted promptly and responsively in submitting names as required.

27.1.3 The CONTRACTOR shall not change a SUBCONTRACTOR, person or entity previously selected if the OWNER or ENGINEER makes reasonable objection to such substitute.

27.2 The CONTRACTOR shall not award WORK to SUBCONTRACTOR(s) in excess of fifty (50) percent of the CONTRACT PRICE without prior written approval of the OWNER.

27.3 The CONTRACTOR shall be fully responsible to the OWNER for the acts and omissions of its SUBCONTRACTORs, and of persons either directly or indirectly employed by them, as they are for the acts and omissions of persons directly employed by them.

27.4 The CONTRACTOR shall cause appropriate provisions to be inserted in all subcontracts relative to the WORK to bind SUBCONTRACTORs to the CONTRACTOR by the terms of the CONTRACT DOCUMENTS insofar as applicable to the WORK of SUBCONTRACTORs and to give the CONTRACTOR the same power as regards terminating any subcontract that the OWNER may exercise over the CONTRACTOR under any provision of the CONTRACT DOCUMENTS. Each subcontract agreement shall preserve and protect the rights of the OWNER and ENGINEER under the CONTRACT DOCUMENTS with respect to the WORK to be performed by the SUBCONTRACTOR so that subcontracting thereof will not prejudice such rights, and shall allow to the SUBCONTRACTOR, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the CONTRACTOR that the CONTRACTOR, by the CONTRACT DOCUMENTS, has against the OWNER. Where appropriate, the CONTRACTOR shall require each SUBCONTRACTOR to enter into similar agreements with SUB-SUBCONTRACTORS.

27.5 Nothing contained in this CONTRACT shall create any contractual relation between any SUBCONTRACTOR and the OWNER.

27.6 The provisions of Subparagraph 27.1 through 27.54 shall not apply to the designated filed Sub-Bidders under this CONTRACT. Such Subcontracts shall be in accordance with Chapter 149, Section 44A through 44I inclusive of the General Laws of Massachusetts as amended.

27.7 The subcontract for Filed Sub-Bidders shall be the FORM FOR SUBCONTRACT included in the CONTRACT DOCUMENTS or, if not published with these specifications, it shall be the form and language established by Chapter 149 of the Massachusetts General Laws.

28. ENGINEER'S AUTHORITY

28.1 Not Used.

28.2 Not Used.

28.3 Not Used.

28.4 Not Used.

28.5 Not Used.

28.6 Not Used.

28.7 See OWNER/CONTRACTOR AGREEMENT.

29. LAND AND RIGHTS-OF-WAY

29.1 Prior to issuance of the NOTICE TO PROCEED, the OWNER shall obtain all land and rights-of-way necessary for carrying out and for the COMPLETION of the WORK to be performed pursuant to the CONTRACT DOCUMENTS, unless otherwise mutually agreed.

29.2 The OWNER shall provide to the CONTRACTOR information, which delineates and describes the lands owned and rights-of-way acquired.

29.3 The CONTRACTOR shall provide at the CONTRACTOR's expense and without liability to the OWNER any additional land and access thereto that the CONTRACTOR may desire for temporary construction facilities or for storage of materials.

30. GUARANTY

30.1 The CONTRACTOR warrants that the materials and equipment furnished under the CONTRACT will be new and of recent manufacture and that all WORK will be of good quality, free from faults and defect, and in conformance with the CONTRACT DOCUMENTS. WORK not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the ENGINEER, the CONTRACTOR shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

30.1.1 Materials, supplies, or equipment to be incorporated into the WORK shall not be purchased by the CONTRACTOR subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. All materials are to be of the best and finest quality of their several kinds.

30.1.2 The CONTRACTOR guarantees and warrants to the OWNER that all labor furnished under this CONTRACT will be competent to perform the tasks undertaken that the product of such labor will yield only first-class results.

30.2 The CONTRACTOR shall be solely responsible for determining that all materials furnished for the WORK meet all of the 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, and 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.

30.3 In all cases in which the 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 named manufacturers without substitution, unless a written request for substitution has be submitted by the CONTRACTOR and approved in writing by the ENGINEER.

30.4 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 deviation at the time the material is submitted for approval, and shall request written approval of the deviation from the requirements of the CONTRACT DOCUMENTS.

30.5 In requesting approval of deviations and substitutions, the CONTRACTOR shall provide, upon request, evidence leading to the reasonable certainty that the proposed substitution or deviation will provide a quality of results at least equal to that otherwise attainable. If, in the opinion of the ENGINEER, the evidence may reject such substitution or deviation without further investigation.

30.6 The CONTRACT Documents are intended to produce a building of consistent character and quality of design. All components of the building including visible items and 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 material specified proposed substitutes that, in the ENGINEER's opinion, would be out of character, obtrusive, or otherwise inconsistent with the character and 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 substitute material in any color, finish, texture or pattern which would have been available from the manufacturer originally specified at no additional cost to the OWNER.

30.7 Any additional costs, or any loss or damage arising from the substitution of any material or any method of those originally specified shall be born by the CONTRACTOR, not withstanding approval or acceptance of such substitution by the OWNER or the ENGINEER, unless such substitution was made at the written request or direction of the OWNER or ENGINEER.

30.8 The OWNER retains the authority of final decisions with respect to substitutions.

30.9 The warranty provided in this paragraph 30 shall be in addition to and not in limitation of any warranty required by the CONTRACT Documents or otherwise described by law.

30.10 The CONTRACTOR shall secure and deliver to the ENGINEER, no later than the date claimed by the CONTRACTOR as the date of substantial completion, all special warranties required by the CONTRACT Documents. Delivery by the CONTRACTOR shall constitute the CONTRACTOR's guarantee to the OWNER that the warranty will be performed in accordance with its terms and conditions.

30.11 All warranties and guarantees shall commence on the date of Substantial Completion. Warranties and guarantees shall extend for a minimum of one year. Notwithstanding the forgoing, any special warranties, as defined by the ENGINEER, required by the CONTRACT Documents or manufacturers' standard warranties, extending longer than one year, shall remain in effect for the full warranty period.

30.12 All guarantees and warranties required in the various Sections of the Specifications which originate with a Subcontractor or Manufacturer must be delivered to the OWNER before final payment to the CONTRACTOR may be made for the amount of that sub trade or for the phase of work to which the guarantee or warranty relates. The failure to deliver a required guarantee or warranty shall be held to constitute a failure of the Subcontractor to fully complete his work in accordance with the CONTRACT Documents. The CONTRACTOR's obligation to correct work is in addition to, and not in substitution of, such guarantees or warranties as may be required in the various Sections of the Specifications.

31. CLAIMS AND DISPUTES

31.1 Not Used.

31.2 Not Used.

31.3 Not Used.

31.4 Not Used.

31.5 Not Used.

31.6 Not Used.

31.7 Not Used.

31.8 Not Used.

31.9 Not Used.

31.10 Not Used.

31.11 Not Used.

31.12 Not Used.

31.13 Not Used.

31.14 See OWNER/CONTRACTOR AGREEMENT.

32. MEDIATION AND ARBITRATION

32.1 A claim, dispute or other matter may be submitted to mediation at the sole discretion of the OWNER, as provided in Paragraph 31.8.

32.2 At the sole discretion of the OWNER, the OWNER and CONTRACTOR may endeavor to resolve their Claims and other matters in question between them by mediation and negotiation which, unless the parties otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the CONTRACTOR and with the American Arbitration Association.

32.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the PROJECT is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

32.4 If negotiation or mediation fails to bring about resolution of any Claim, then at the OWNER's sole discretion, the Claim shall be subject to arbitration, as provided in Paragraph 31.8.

32.5 Notwithstanding any provision contained in this Paragraph or elsewhere in the CONTRACT DOCUMENTS, the OWNER reserves the following rights in connection with claims and disputes between the OWNER and the CONTRACTOR.

32.5.1 The right to institute legal action against the CONTRACTOR in any court of competent jurisdiction in lieu of demanding arbitration.

32.5.2 The right to obtain from any court of competent jurisdiction, a stay of any arbitration instituted by the CONTRACTOR, in which case the dispute or disputes shall be decided by litigation, and not by arbitration.

32.6 Judgment on Final Award. The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with the applicable law in any court having jurisdiction thereof.

33. TAXES

33.1 The CONTRACTOR is an exempt purchaser under the Massachusetts Sales Act, Chapter 14 of the Acts of 1966, to the extent that materials and supplies are used or incorporated in the performance of the CONTRACT. The CONTRACTOR shall obtain from the OWNER an exemption certificate number to be used in lieu of paying the tax on exempted items.

34. INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

34.1 The SPECIFICATIONS and the DRAWINGS are intended to describe and provide for a completed PROJECT. They are intended to be complementary, and what is called for by either shall be complete in every detail, notwithstanding that every item necessarily involved is not particularly mentioned, and the CONTRACTOR shall provide all labor and materials necessary for the entire COMPLETION of the WORK intended to be described.

34.2 Since the CONTRACT DOCUMENTS are complimentary, before starting each portion of the WORK, the CONTRACTOR shall carefully study and compare the various DRAWINGS and other CONTRACT DOCUMENTS relative to that portion of the WORK, as well as any information furnished by the OWNER, shall take field measurements of any existing conditions related to that portion of the WORK and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating construction by the CONTRACTOR and are not for the purpose of discovering errors, omissions, or inconsistencies in the CONTRACT DOCUMENTS; however, any errors, inconsistencies or omissions discovered by the CONTRACTOR shall be reported promptly to the ENGINEER in writing as a request for information in such form as the ENGINEER may require. Before starting the work and at frequent intervals during the progress thereof, the CONTRACTOR shall carefully study and compare the CONTRACT DOCUMENTS with each other and with the information furnished by the OWNER and shall at once report to the ENGINEER any error, inconsistency or omission the CONTRACTOR may discover. Any necessary change will be ordered as provided in Article 14. If the CONTRACTOR proceeds with the WORK without such notice, the ENGINEER, having discovered such errors, inconsistencies or omissions, or if by reasonable study of the CONTRACT DOCUMENTS he could be discovered such, the CONTRACTOR shall bear all cost arising therefrom.

34.3 Any design errors or omissions noted by the CONTRACTOR during this review shall be reported promptly to the ENGINEER in writing, but it is recognized that the CONTRACTOR's review is made in the CONTRACTOR's capacity as a contractor and not as a licensed design professional unless otherwise specifically provided in the CONTRACT DOCUMENTS.

35. SITE REGULATIONS

35.1 On or before the COMPLETION of the WORK, the CONTRACTOR shall without charge therefor tear down and remove all buildings and other temporary structures built by the CONTRACTOR, and shall remove and legally dispose of surplus material and rubbish of all kinds from any ground which it has occupied and shall leave the WORK, grounds and surroundings in a clean and neat condition.

35.2 Tobacco, Drugs and Liquor Prohibited. The CONTRACTOR shall neither permit nor suffer smoking where it creates a hazard nor the introduction or use of drugs, spirituous or intoxicating liquors upon or about the WORK embraced in this CONTRACT or upon any of the ground occupied by the CONTRACTOR.

35.3 Posters. The CONTRACTOR shall not permit or suffer any placards, posters or advertisements to be displayed on or about the premises unless approved by the OWNER.

36. LIMITATIONS OF DATA PRESENTED

36.1 DRAWINGS, surveys, measurements, dimensions, calculations, estimates, borings and statements as to the condition under which the WORK is to be performed are believed to be correct.

36.2 The BIDDER shall carefully examine the CONTRACT DOCUMENTS, including all DRAWINGS, SPECIFICATIONS and ADDENDA, shall visit the site(s) and shall satisfy itself as to the type and quantity of the WORK to be performed. For the purposes of comparing several proposals, the BID shall be based on the data presented and the BIDDER's examination of the site(s).

36.3 The locations of all utilities are obtained from the best available sources and are to be considered as approximate insofar as size, location and elevation are concerned. Furthermore, it is expressly understood that there may be utilities in existence other than those shown on the DRAWINGS.

37. HEALTH AND SAFETY EQUIPMENT

37.1 As provided for in Article 12, the CONTRACTOR is responsible for establishing and maintaining a health and safety program throughout the course of the PROJECT so as to meet all local, STATE, federal and OSHA requirements.

37.2 In order for the OWNER and/or ENGINEER to observe the WORK, the CONTRACTOR shall provide health and safety equipment for such purposes. Such equipment shall specifically include, but not necessarily be limited thereto, the following:

37.2.1 Ear plugs in sufficient quantities

37.2.2 Headset protective hearing devices

37.2.3 Safety glasses/goggles

37.2.4 3-way gas detector meter with lights and alarm (hydrogen sulfide, combustible gases and oxygen deficiency)

37.2.5 Tripod (mechanical crank type especially designed and equipped for lifting personnel in and out of confined spaces)

37.2.6 Ropes and harnesses

37.2.7 Disposable coveralls/protective clothing/gloves in sufficient quantity and sizes

37.2.8 Ventilating equipment for confined spaces

37.2.9 Self-contained breathing apparatus (SCBA)

37.3 All of the above equipment shall be continuously provided at the worksite(s) and maintained in good working order (including manufacture's recommended maintenance and calibration of the 3-way gas detector and SCBA equipment). It is understood that such equipment shall remain the property of the CONTRACTOR and is in addition to any and all health and safety equipment that the CONTRACTOR is required to have for the CONTRACTOR's health and safety program on-site.

37.4 The CONTRACTOR is advised that the OWNER has clearly established on-going Confined Space and Lock-out/Tag-out programs. Where the CONTRACTOR's WORK requires confined space entry into existing facilities and/or lock-out/tag-out of existing equipment and electrical controls, the CONTRACTOR shall strictly abide by the OWNER's programs if they are more stringent than the CONTRACTOR's own procedures.

37.5 The CONTRACTOR shall comply with the requirements of the Occupational Safety and Health Act and the Construction Safety Act of 1969, which are incorporated herein by reference, and all standards and regulations promulgated by the governmental and regulatory bodies responsible for administration thereof. The CONTRACTOR shall be responsible for compliance with such Acts, standards and regulations by its officers, agents, employees, Subcontractors, Sub-subcontractors, suppliers and material. The CONTRACTOR shall indemnify and hold harmless the OWNER and the ENGINEER from any and all fines, costs and expenses, including but not limited to reasonable attorney’s fees, incurred by OWNER, its ENGINEER due to violation of such Acts, standards and/or regulations.

38. INITIAL SUPPLIES

38.1 Provide for each piece of equipment delivered and/or installed, a one years supply of oil and grease.

38.2 Provide for each tank supplied for chemical and fuel, a full tank of each respective material

39. CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

39.1 The OWNER reserves the right to perform construction or operations related to the PROJECT with the OWNER’s own forces, and to award separate contracts in connection with other portions of the PROJECT or other construction or operations on the site under conditions of the contract identical or substantially similar to these including those portions related to insurance. If the CONTRACTOR claims that delay or additional cost is involved because of such action by the OWNER, the CONTRACTOR shall make such Claim as provided in this Paragraph 31.6.

39.1.1 The OWNER may award other contracts for additional work. The CONTRACTOR shall cooperate fully with other contractors, afford other contractors reasonable opportunity for the introduction and storage of their material and the execution of their work, and carefully fit its own work to that of other contracts as may be directed by the OWNER. The OWNER shall not commit or permit any acts which will interfere with the performance of work by any other contractor.

39.1.2 If such separate contractor sues or initiates an arbitration proceeding against the OWNER on account of any damage alleged to have been caused by the CONTRACTOR, the OWNER shall notify the CONTRACTOR, who shall defend such proceedings at the OWNER’s expense, and if any judgment or award against the OWNER arises therefrom the CONTRACTOR shall pay or satisfy it and shall reimburse the OWNER for all attorney’s fees and court or arbitration costs which the OWNER has incurred.

39.1.3 The OWNER reserves the right to access any part of the PROJECT at any time to install other WORK, either with its own forces or with separate contractors hired by the OWNER. Such access is not to be construed as partial occupancy by the OWNER. The CONTRACTOR shall permit the OWNER to place and install furniture, equipment and other acceptance of the WORK or any portion thereof.

39.2 The OWNER shall provide for coordination of the activities of the OWNER's own forces and of each separate contractor with the WORK of the CONTRACTOR, who shall cooperate with them. The CONTRACTOR shall participate with the other separate contractors and the OWNER in reviewing their construction schedules when directed to do so. The CONTRACTOR shall make any revisions to the construction schedule 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 OWNER until subsequently revised.

40. MISCELLANEOUS

40.1 The CONTRACTOR agrees as a material obligation to this CONTRACT to pay its own laborers and to ensure that its subcontractors, material suppliers and sub-subcontractors pay their own laborers employed on the PROJECT, wages in an amount no less than the applicable prevailing wage rates established for the PROJECT by the Massachusetts Department of Labor and Industries. The CONTRACTOR shall defend and indemnify the OWNER for, from and against any loss, expense, damages, actions, or claims (including any expense incurred in connection with any delay or stoppage of the WORK) arising out of or related to the CONTRACTOR's failure to comply with such laws or regulations.

40.2 By executing the CONTRACT DOCUMENTS, the CONTRACTOR certifies under the pains and penalties of perjury pursuant to Chapter 62C, Section 49A(b) of the Massachusetts General Laws that the CONTRACTOR has complied with all of the laws of the Commonwealth of Massachusetts relating to taxes.

40.3 The CONTRACTOR shall keep itself fully informed of and comply with all existing and future federal, state and municipal laws and regulations and all orders and decrees of any governmental bodies or tribunals (hereinafter also referred to as 'laws') having jurisdiction in any manner which affect this contract or construction, including but not limited to such laws affecting those engaged or employed in the work, the materials used in the work or in any way affecting the conduct of the work. If any clause in this contract does not conform to such law, then such clause shall be void and the law operative shall be inserted in lieu thereof. If any discrepancy or inconsistency is discovered in the specifications, drawings, or contract documents in violation of the law, the CONTRACTOR shall forthwith report the same in writing to the OWNER. The CONTRACTOR shall cause its employees, agents and subcontractors to also observe and comply with all such laws. It shall protect and indemnify the Town and its officials, employees and duly appointed agents against any claim or liability arising from or based on any violation, whether by the CONTRACTOR or its officials, employees or subcontractors, of any such law.

40.4 All material and workmanship (if not otherwise designated by the CONTRACT DOCUMENTS) shall be subject to inspection, examination, and test by the ENGINEER at any and all times during manufacture and/or construction and at any and all places where such manufacture and/or construction are carried on. The ENGINEER shall have the right to reject defective material and workmanship or require its correction. Rejected workmanship shall be satisfactorily replaced with new and proper material, and rejected material promptly removed from the premises. If the CONTRACTOR fails to proceed at once with the replacement of rejected material and/or the correction of defective workmanship, the OWNER may by contract or otherwise replace such material and/or correct such workmanship and charge the cost to the CONTRACTOR, or may terminate the right of the CONTRACTOR to proceed, the CONTRACTOR and Surety being liable for any damage to the same extent as provided.

40.5 The CONTRACTOR shall keep the ENGINEER informed of the progress of his work. No work shall be closed or covered until it has been duly inspected and approved. Should uninspected work be covered, the CONTRACTOR shall, at his own expense, uncover all such work so that it can be properly inspected and after such inspection, he shall properly repair and replace all work interfered with.

40.6 The CONTRACTOR shall obtain and deliver promptly to the ENGINEER any Occupancy Permit and any certificates of final inspection of any part of the CONTRACTOR's WORK and operating permits for any mechanical apparatus, such as elevators, escalators, boilers, and air compressors, which may be required by law to permit full use and occupancy of the premises by the OWNER. Receipt of such permits or certificates by the ENGINEER shall be a condition precedent to determining that the WORK is Substantially Complete.

40.7 No laborer, worker, mechanic, foremen or inspector working within the Commonwealth of Massachusetts in the employ of the CONTRACTOR, subcontractors or other persons doing or contracting to do the whole or part of the work contemplated by this contract, shall be required or permitted to work more than 8 hours in any one calendar day; or more than 48 hours in one week, or more than 6 days in any one week in full compliance with the provisions of M.G.L. c.149, §34, except in cases of emergencies.

40.8 Weekly Wages. M.G.L. c. 149, §148, requires the weekly payment of employees.

40.9 Workers Compensation. Failure to provide and continue in force such insurance as aforesaid shall be deemed a material breach of the CONTRACT and shall entitle the OWNER to terminate the CONTRACT without in any way being liable in damages therefore.

40.10 Register of Employees. The CONTRACTOR shall keep a true and accurate register of all mechanics, teamsters, chauffeurs and laborers employed upon the work contemplated by this CONTRACT showing the name, address and occupational classification of each such employee, the hours worked by and the wages paid to each such employee, and shall furnish the Massachusetts Department of Labor and Industries upon its request a true statement thereof.

40.11 Lodging, Board, Trade – Freedom. The CONTRACTOR shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees as may be necessary to comply with the requirements of the appropriate authorities. The maintenance of all sanitary facilities shall be subject to the laws of the Commonwealth and to the rules and regulations of the State Board of Health and the Board of Health for the Town.

40.12 Wage Rates (M.G.L. c. 149, §26, et seq.). Payments by employers to health and welfare plans, pension plans and supplementary unemployment benefit plans under collective bargaining agreements or understandings between organized labor and employers shall be included for the purpose of establishing minimum wage rates as herein provided. The OWNER shall assume no responsibility for the accuracy of the rates set forth in the schedule and no claims for additional compensation will be considered because of the inaccuracy in the rates so set forth. The schedule of wages referred to above are minimum rates only, the OWNER will not consider any claim for additional compensation made by the CONTRACTOR because of any payment by the CONTRACTOR of any wage rate in excess of said minimum rates. All substantive and procedural requirements of the minimum wage rate laws shall be met. The schedule of rates shall be kept posted in a conspicuous place at the site of the work.

40.13 “Right to Know” Law. If the CONTRACTOR uses or stores toxic hazardous substances he is subject to M.G.L. c.111F, §2, the ‘Right to Know” law and regulations promulgated by the Department of Public Health, the Department of Environmental Protection and the Department of Labor and Industries; and must post a Workplace Notice obtainable from the Department of Labor and Industries.

40.14 Preference to Veterans and Citizens in Public Works. General Laws, Chapter 149, Section 26 is incorporated by reference herein.

40.15 Clerk’s Certificate – Corporation. If the CONTRACTOR is a corporation, it shall endorse upon the contract (or attach hereto) its Clerk’s Certificate certifying the corporate capacity and authority of the party signing this contract for the corporation. Such certificate shall be accompanied by a letter or other instrument stating that such authority continues in full force and effect as of the date the contract is executed by the CONTRACTOR.

40.16 Foreign Corporation. The CONTRACTOR, if a foreign corporation, shall comply with M.G.L. c.181, §3 and 5 and M.G.L. c.30, §39L.

40.17 Municipal Prerequisites. This contract shall not be enforceable against the OWNER unless and until the CONTRACTOR complies with this section. This contract is only binding upon, and enforceable against the OWNER if:

40.17.1 the contract is signed by the Town of Plymouth Board of Selectmen or its designee; and

40.17.2 endorsed with approval by the Town Accountant as to appropriation or availability of funds; and

40.17.3 endorsed with the approval of the Town Counsel as to form.

40.18 Subject to Appropriation. The obligations of the OWNER hereunder shall be subject to appropriation on a fiscal year basis. In the absence of appropriation, this agreement shall be terminated immediately without liability of the OWNER for damages, lost profits, penalties, or other charges arising from early termination.

40.19 Conflict of Interest. Both the OWNER and the CONTRACTOR stipulate to the applicability of the State Conflict of Interest Law (General Laws Chapter 268A), and this contract expressly prohibits any activity which shall constitute a violation of that law. The CONTRACTOR shall be deemed to have investigated its applicability to the performance of this contract; and by executing the contract documents the CONTRACTOR certifies to the OWNER that neither it nor its agents, employees or subcontractors are thereby in violation of General Laws Chapter 268A.

40.19.1 The CONTRACTOR warrants that it has complied with all provisions of law regarding the award of this contract and that it, or its employees, agents, officers, directors or trustees have not offered or attempted to offer anything of any value to any official or employee of the OWNER in connection with this CONTRACT.

40.19.2 The CONTRACTOR further warrants that no official or employee of the Town including unpaid members of Town boards and commissions, serves as an officer, director, trustee or employee of the CONTRACTOR, and that no official or employee of the Town has or will have a direct or indirect financial interest in this CONTRACT.

40.19.3 The CONTRACTOR shall not during the term of this CONTRACT hire or employ on either a full-time or part-time basis any person or persons employed by the OWNER.

40.19.4 Violation of this Article shall be a material breach of this contract and shall be grounds for immediate termination of this contract by the OWNER without regard to any enforcement activities undertaken or contemplated by any enforcement agency. Termination of this contract pursuant to this Article shall not waive any claims for damages the OWNER may have against the CONTRACTOR resulting from the CONTRACTOR's violation of the terms of this Article.

40.20 Assignment or Transfer of Contract. The CONTRACTOR shall not sell, transfer, assign by power of attorney or otherwise, sublet, or otherwise dispose of the work or any part thereof, without the previous written consent of the OWNER by its Contracting Officer. Nor shall the CONTRACTOR either legally or equitably assign any of the moneys payable under this CONTRACT or any claim thereto unless by and with like written consent on the part of the Contracting Officer and the Town Treasurer.

40.21 Record Keeping and Management Controls. The CONTRACTOR shall comply with M.G.L. c.30, §39R.

40.22 Not Used.

40.23 Reserve Police Officer. In accordance with M.G.L. c.149, §34B, the CONTRACTOR shall pay to any reserve police officer employed by it the prevailing wage paid to regular police officers.

40.24 Severability. If any provision of this CONTRACT is held invalid by any court or body of competent jurisdiction, the remainder of this CONTRACT shall remain in full force and effect.

40.25 Headings. The section headings in this CONTRACT are for convenience and reference only and in no way define or limit the scope or content of this contract or in any way affect its provisions.

40.26 Liability of Public Officials. To the fullest extent permitted by law, no official, employee, agent, or representative of the Town shall be individually or personally liable on any obligation of the Town under this contract.

40.27 Independent Contractor. The CONTRACTOR is not an employee or agent of the OWNER, but is an independent contractor.

40.28 Certification of Non-Debarment or Suspension (M.G.L. c.29, §29F). By execution of this CONTRACT, the CONTRACTOR, pursuant to Section 29F of Chapter 29 of the Massachusetts General Laws, certifies under the penalties of perjury that it is not presently debarred or suspended from doing public construction work in the Commonwealth pursuant to said section, or any applicable debarment or suspension provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

END OF DOCUMENT

DOCUMENT 00852

SPECIAL CONDITIONS - GENERAL

1.01 STATUTORY REQUIREMENTS IN GENERAL

A. Owner and Contractor recognize that other rights, duties, and obligations with respect to public construction contracts are also provided by statute, notwithstanding the fact that they may not be specifically enumerated herein. Accordingly, any provisions required by statute to be included in this contract shall be deemed to be so included as though fully set forth herein. However, compliance with a statute does not diminish the Contractor's responsibilities hereunder.

B. Contractor shall keep fully informed of all existing and future State and Federal Laws and municipal ordinances and regulations in any manner affecting those engaged or employed in the Work, or the materials used or employed in the Work, or in any way affecting the conduct of the Work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same and of all provisions required by law to be made a part of this Contract, all of which provisions are hereby incorporated by reference and made a part thereof. If any discrepancy or inconsistency is discovered in the Contract Documents for this Work in relation to any such law, ordinance, regulation, order or decree, report the same to the Engineer in writing. Contractor shall, at all times, observe and comply with, and cause all agents and employees to observe and comply with all such existing and future laws, ordinances, regulations, orders and decrees; and shall protect and indemnify the Owner and Engineer and all of its and their officers, agents, and servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by itself or its employees or subcontractors.

C. All materials furnished and Work done shall comply with all State and Federal laws and regulations.

1.02 POLICE OFFICERS

A. Any police officers, reserve, special or otherwise, employed by the Contractor, shall be paid the prevailing wage rates paid to regular police officers of the municipality in which the Work is to be performed.

1.03 RELATION OF SEWER MAINS TO WATER LINES

A. Horizontal Separation

1. At a minimum, sewers should be laid at least 10 feet, horizontally, from any existing and/or proposed water mains.

2. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if:

a. It is laid in a separate trench.

b. It is laid in the same trench with the water mains located at one side on a bench of undisturbed earth.

In either case the elevation of the crown of the sewer is at least 18 inches below the invert of the water main.

B. Vertical Separation

1. Whenever sewers must cross under water mains, the sewer shall be laid at such elevation that the top of the sewer is at least 18 inches below the bottom of the water main.

2. When the elevation of the sewer cannot be buried to meet the above requirement, both pipes will be encased in flowable fill for a distance of 10 feet on either side of the crossing.

C. Special Conditions

1. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the water main shall be constructed of slip-on or mechanical-joint cast-iron pipe or prestressed concrete cylinder pipe and the sewer constructed of mechanical-joint cast-iron pipe and both services shall be pressure tested to assure water tightness.

1.04 UTILITY COORDINATION

A. Contractor shall be responsible for contacting and coordinating with utility companies prior to commencing work in the area of utilities. Special requirements may be necessary for work in the vicinity of some utilities and easements. Requirements may include but are not limited to the following; surface marking of crossings and easements, temporary fencing, temporary pipe support, additional padding or steel plates for heavy equipment, and coordination with utility field personnel. Guidelines provided by NSTAR and Spectra Energy are included as attachments to 00858 – SPECIAL CONDITIONS PERMITS AND LICENSES.

1.05 EPA CONSTRUCTION GENERAL PERMIT

A. Construction activities associate with the project are anticipated to disturb one or more acres and as such would be regulated under the National Pollutant Discharge Elimination System (NPDES) stormwater program. Construction stormwater discharges are permitted under the Construction General Permit (CGP) and requires compliance with permit requirements, such as the development of a Stormwater Pollution Prevention Plan (SWPPP). Contractor shall be responsible for preparing and submitting an EPA Notice or Intent (NOI) through the EPA's electronic NOI system (eNOI). Contractor shall responsible for creating the required SWPPP and updating this document as necessary to reflect changes. Additional information on obtaining a CGP can be found at the links provided below.

http://water.epa.gov/polwaste/npdes/stormwater/Applying-for-Coverage-under-the-Construction-General-Permit-CGP.cfm

http://water.epa.gov/polwaste/npdes/stormwater/upload/cgp2012_finalfactsheet.pdf

END OF DOCUMENT

DOCUMENT 00855

SPECIAL CONDITIONS
COMMONWEALTH OF MASSACHUSETTS

INDEX

Massachusetts General Laws (most current edition)

While reasonable efforts have been made to assure the accuracy of the data provided, Contractor shall not rely on this information without first checking an official edition of the Massachusetts General Laws (MGL). Full text, verbatim statues may be accessed from the "GENERAL LAWS OF MASSACHUSETTS: Published in Cooperation with the Massachusetts Bar Association" by the General Court and other sources including: "http://www.state.ma.us/legis/laws/mgl/(insert chapter number reference).htm"

Article 1 - Construction contracts; subcontractor defined;...direct payment...
(MGL C.30, s.39F)

Article 2 - Completion of public works; semi-final and final estimates;
payments; extra work; disputed items (MGL. C.30, s.39G)

Article 3 - Deviations from plans and specifications
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Article 4 - Public construction contracts; effect of decisions...
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Article 7 - Contracts...; manner of awarding
(MGL C.30, s.39M)

Article 8 - (claims)...for...(unforeseen) conditions
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(MGL C.30, s.39O)

Article 10 - decisions...(and approvals by engineer or architect)
(MGL C.30, s.39P)

Article 11 - (record keeping)
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Article 12 - Contracts for Construction, requirements
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Article 13 – Public works; Preference to veterans and citizens; wages
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Article 15 - Minimum Wage Rates
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- "Weekly Payroll Records Report and Statement of Compliance"
  (Statement of Compliance to be furnished to the Massachusetts Department of Labor within fifteen (15) days after completion of work)
- "Weekly Payroll Report Form"
- "Minimum Wage Rates for Apprentices"

Article 16 - Notice Requirements for Excavations in Public Ways
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Article 17 - Invitations to bid; notice; contents...
(MGL C.149, ss.44J in part)

Article 18 - Plans and Specifications; Subbids; Form; Contents
(MGL C.149, ss.44F)

Article 19 - Allowances; Alternates; Weather Protection Devices
(MGL C.149, ss.44G)

Article 1. CONSTRUCTION CONTRACTS;...SUBCONTRACTOR DEFINED;...DIRECT PAYMENT....
(General Laws, Chapter 30, 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 the 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 the 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 form 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 a 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 for 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 Subbid and receives a subcontract as a result of that filed subbid 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 to 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 provide din 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."

Article 2. COMPLETION OF PUBLIC WORKS; SEMI-FINAL AND FINAL ESTIMATES; PAYMENTS; EXTRA WORK; DISPUTED ITEMS
(General Laws, Chapter 30, Section 39G)

"Upon substantial completion of the work required by a contract with the commonwealth, or any agency or political subdivision thereof, for the construction, reconstruction, alteration, remodeling, repair or improvement of public ways, including bridges and other highway structures, sewers and, water mains, airports and other public works, the contractor shall present in writing to the awarding authority its

certification that the work has been substantially completed. Within twenty-one days thereafter, the awarding authority 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 awarding authority may include with such a list a notice setting forth a reasonable time, which shall not in any event be prior to the contract completion date, within which the contractor must achieve substantial completion of the work. In the event that the awarding authority fails to respond, by presentation of a written declaration or itemized list as aforesaid, to the contractor's certification within the twenty-one day period, the contractor's certification shall take effect as the awarding authority's declaration that the work has been substantially completed.

Within sixty-five days after the effective date of a declaration of a substantial completion, the awarding authority shall prepare and forthwith send to the contractor for acceptance a substantial completion estimate for the quantity and price of the work done and all but one percent retainage on that work, including the quantity, price and all but one percent retainage for the undisputed part of each work item and extra work item in dispute but excluding the disputed part thereof, less the estimated cost of completing all incomplete and unsatisfactory work items and less the total periodic payments made to date for the work. The awarding authority also shall 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 section thirty-nine F, but no contract subject to said section thirty-nine F shall contain any other provision authorizing the awarding authority to deduct any amount by virtue of claims asserted against the contract by subcontractors, material suppliers or others.

If the awarding authority fails to prepare and send to the contractor any substantial completion estimate required by this section on or before the date herein above set forth, the awarding authority will 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 percentage points above the rediscount rate then charged by the Federal Reserve Bank of Boston from such date to the date on which the awarding authority sends that substantial completion estimate to the contractor for acceptance or to the date of payment therefor, whichever occurs first. The awarding authority shall include the amount of such interest in the substantial completion estimate.

Within fifteen days after the effective date of the declaration of substantial completion, the awarding authority shall send to the contractor by certified mail, return receipt requested, a complete list of all incomplete or unsatisfactory work items, and, unless delayed by causes beyond his control, the contractor shall complete all such work items within forty-five days after the receipt of such list or before the then contract completion date, whichever is later. If the contractor fails to complete such work within such time, the awarding authority may, subsequent to seven days' written notice to the contractor by certified mail, return receipt requested, terminate the contract and complete the incomplete or unsatisfactory work items and charge the cost of same to the contractor.

Within thirty days after receipt by the awarding authority of a notice from the contractor stating that all of the work required by the contract has been completed, the awarding authority 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 that work less all payments made to date, unless the awarding authority's inspection shows that work items required by the contract remain incomplete or unsatisfactory, or that documentation required by the contract has not been completed. If the awarding authority fails to prepare and send to the contractor the final estimate within thirty days after receipt of notice of completion, the awarding authority shall pay to the contractor interest on the amount which would have been due to the contractor pursuant to such final estimate at the rate hereinabove provided from the thirtieth day after such completion until the

date on which the awarding authority sends the final estimate to the contractor for acceptance or the date of payment therefor, whichever occurs first, provided that the awarding authority's inspection shows that no work items required by the contract remain incomplete or unsatisfactory. Interest shall not be paid hereunder on amounts for which interest is required to be paid in connection with the substantial completion estimate as hereinabove provided. The awarding authority shall include the amount of the interest required to be paid hereunder in the final estimate.

The awarding authority shall pay the amount due pursuant to any substantial completion or final estimate within thirty-five days after receipt of written acceptance for such estimate from the contractor and shall pay interest on the amount due pursuant to such estimate at the rate hereinabove provided from that thirty-fifth day to the date of payment. Within 15 days, 30 days in the case of the commonwealth, after receipt from the contractor, at the place designated by the awarding authority, if such place is so designated, of a periodic estimate requesting payment of the amount due for the preceding periodic estimate period, the awarding authority shall make a periodic payment to the contractor for the work performed during the preceding periodic estimate period 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, upon certification by the contractor that he is the lawful owner and that the materials are free from all encumbrances. The awarding authority shall include with each such payment interest on the amount due pursuant to such periodic estimate at the rate herein above provided from the due date. In the case of periodic payments, the contracting authority 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 demand for same in accordance with the provisions of section thirty-nine F, and a retention to secure satisfactory performance of the contractual work not exceeding five percent of the approved amount of any periodic payment, and the same right to retention shall apply to bonded subcontractors entitled to direct payment under section thirty-nine F of chapter thirty; provided, that a five percent value of all items that are planted in the ground shall be deducted from the periodic payments until final acceptance.

No periodic, substantial completion or final estimate or acceptance or payment thereof shall bar a contractor from reserving all rights to dispute the quantity and amount of, or the failure of the awarding authority to approve a quantity and amount of, all or part of any work item or extra work item.

Substantial completion, for the purposes of this section, shall mean either that the work required by the contract has been completed except for work having a contract price of less than one percent of the then adjusted total contract price, or substantially all of the work has been completed and opened to public use except for minor incomplete or unsatisfactory work items that do not materially impair the usefulness of the work required by the contract."

Article 3. DEVIATIONS FROM PLANS AND SPECIFICATIONS
(General Laws, Chapter 30, 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 willful 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."

Article 4. PUBLIC CONSTRUCTION CONTRACTS; EFFECT OF DECISIONS...
(General Laws, Chapter 30, 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, 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."

Article 5. PUBLIC BUILDING CONSTRUCTION CONTRACTS; PAYMENTS
(General Laws, Chapter 30, Section 39K)

"Every contract for the construction, reconstruction, alteration, remodeling, repair or demolition of any public building by the commonwealth, or by any county, city, town, district, board, commission, or other public body, when the amount 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, shall contain the following paragraph: ‘Within fifteen days (30 days in the case of the commonwealth, including local housing authorities) 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, upon certification by the contractor that he is the lawful owner and that the materials are free from all encumbrances, but 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 percent of the approved amount of the periodic payment. After the receipt of a periodic estimate requesting final payment and within sixty-five days after (a) the contractor fully

completes the work or substantially completes the work so that the value of the work remaining to be done is, in the estimate of the awarding authority, less than one percent 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 then 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 subbid 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.

Notwithstanding the provisions of this section, at any time after the value of the work remaining to be done is, in the estimation of the awarding authority, less than 1 percent of the adjusted contract price, or the awarding authority has determined that the contractor has substantially completed the work and the awarding authority has taken possession for occupancy, the awarding authority may send to the general contractor by certified mail, return receipt requested, a complete and final list of all incomplete and unsatisfactory work items, including, for each item on the list, a good faith estimate of the fair and reasonable cost of completing such item. The general contractor shall then complete all such work items

within 30 days of receipt of such list or before the contract completion date, whichever is later. If the general contractor fails to complete all incomplete and unsatisfactory work items within 45 days after receipt of such items furnished by the awarding authority or before the contract completion date, whichever is later, subsequent to an additional 14 days' written notice to the general contractor by certified mail, return receipt requested, the awarding authority may terminate the contract and complete the incomplete and unsatisfactory work items and charge the cost of same to the general contractor and such termination shall be without prejudice to any other rights or remedies the awarding authority may have under the contract. The awarding authority shall note any such termination in the evaluation form to be filed by the awarding authority pursuant to the provisions of section 44D of chapter 149."

Article 6. PUBLIC CONSTRUCTION WORK BY FOREIGN CORPORATIONS...
(General Laws Chapter 30, 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 subbids 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 such work 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 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."

Article 7. CONTRACTS...; MANNER OF AWARDING
(General Laws, Chapter 30, 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 $25,000.00 but not more than $100,000.00, 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 special 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 produces, and for the equal of any one said named 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) where the provisions of section eight B of chapter twenty-nine apply, shall have been determined to be qualified thereunder; and (4) who obtains within ten days of the notification of contract award the security by bond required under section twenty-nine of chapter one hundred forty-nine; provided that for the purposes of this section the term □security by bond □ shall mean the bond commonwealth and satisfactory to the awarding authority.

(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."

Article 8. (CLAIMS)...FOR....(UNFORESEEN) CONDITIONS
(General Laws, Chapter 30, 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."

Article 9. (CLAIMS)...FOR....DELAY...
(General Laws, Chapter 30, 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 of 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 of failure to act involved in the claim."

Article 10. ...DECISIONS...(AND APPROVALS BY ENGINEER OR ARCHITECT)
(General Laws, Chapter 30, 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."

Article 11. (RECORD KEEPING)
(General Laws, Chapter 30, 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 A1/2 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 of 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/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 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 a 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 term, 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 A1/2 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 of 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 is 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 deputy 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)."

Article 12. CONTRACTS FOR CONSTRUCTION; REQUIREMENTS
(General Laws, Chapter 30, Section 39S)

(a) As used in this section the word “person” shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. Any person submitting a bid for, or signing a contract to work on, the construction, reconstruction, alteration, remodeling or repair of any public work 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 $10,000, and any person submitting a bid for, or signing a contract to work on, the construction, reconstruction, installation, demolition, maintenance or repair of any building by a public agency, estimated to cost more than $10,000, shall certify on the bid, or contract, under penalties of perjury, as follows:

(1) 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; (2) 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 (3) that all employees to be employed in the work subject to this bid 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.

(b) Any employee found on a worksite subject to this section without documentation of successful completion of 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 shall be subject to immediate removal.

(c) The attorney general, or his designee, shall have the power to enforce this section including the power to institute and prosecute proceedings in the superior court to restrain the award of contracts and the performance of contracts in all case where, after investigation of the facts, he has made a finding that the award or performance has resulted in violation, directly or indirectly, of subsection (b), and he shall not be required to pay to the clerk of the court an entry fee in connection with the institution of the proceeding.

Article 13. PUBLIC WORKS; PREFERENCE TO VETERAN'S AND CITIZENS; WAGES
(General Laws, Chapter 149, Section 26 in part)

"In the employment of mechanics and apprentices, teamsters, chauffeurs and laborers in the construction of public works by the commonwealth, or by a county, town, authority or district, or by persons contracting or subcontracting for such works, preference shall first be given to citizens of the commonwealth who have been residents of the commonwealth for at least six months at the commencement of their employment who are male veterans as defined in clause Forty-third of section seven of chapter four, and who are qualified to perform the work to which the employment relates; and secondly, to citizens of the commonwealth generally who have been residents of the commonwealth for at least six months at the commencement of their employment, and if they cannot be obtained in sufficient numbers, then to citizens of the United States, and every contract for such work shall contain a provision to this effect. Each county, town or district in the construction of public works, or persons contracting or subcontracting for such works, shall give preference to veterans and citizens who are residents of such county, town, authority or district. The rate per hour of the wages paid to said mechanics and apprentices, teamsters, chauffeurs and laborers in the construction of public works shall not be less than the rate or rates of wages to be determined by the commissioner as hereinafter provided; provided, that the wages paid to laborers employed on said works shall not be less than those paid to laborers in the municipal service of the town or towns where said works are being constructed; provided, further, that where the same public work is to be constructed in two or more towns, the wages paid to laborers shall not be less than those paid to laborers in the municipal service of the town paying the highest rate; provided, further, that if, in any of the towns where the works are to be constructed, a wage rate or wage rates have been established in certain trades and occupations by collective agreements or understandings in the private construction industry between organized labor and employers, the rate or rates to be paid on said works shall not be less than the rates so established; provided, further that in towns where no such rate or rates have been so established, the wages paid to mechanics and apprentices, teamster, chauffeurs and laborers on public works, shall not be less than the wages paid to the employees in the same trades and occupations by private employers engaged in the construction industry. This section shall also apply to regular employees of the commonwealth or of a county, town, authority or district, when such employees are employed in the construction, addition to or alteration of public buildings for which special appropriations of more than one thousand dollars are provided. Payments by employers to health and welfare plans, pension plans and supplementary unemployment benefit plans under collective bargaining agreements or understandings between organized labor and employers shall be included for the purpose of establishing minimum wage rates as herein provided."...

Article 14. PUBLIC CONTRACTS; HOURS...OF WORK...
(General Laws, Chapter 149, Section 34)

"Every contract, except for the purchase of material or supplies, involving the employment of laborers, workmen, mechanics, foremen or inspectors, to which the commonwealth or any county or town, subject to section thirty, is a party, shall contain a stipulation that no laborer, workman, mechanic, foreman or inspector working within the commonwealth, in the employ of the contractor, subcontractor or other person doing or contracting to do the whole or a part of the work contemplated by the contract, shall be required or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, or more than six days in any one week, except in case of emergency, or, in case any town subject to section thirty-one is a party to such a contract, more than eight hours in any one day, except as aforesaid; provided, that in contracts entered into by the department of highways for the construction or reconstruction of highways there may be inserted in said stipulation a provision that said department, or

any contractor or subcontractor for said department, may employ laborers, workmen, mechanics, foremen and inspectors for more than eight hours in any one day in such construction or reconstruction when, in the opinion of the commissioner of labor and industries, public necessity so requires. Every such contract not containing the aforesaid stipulation shall be null and void."

Article 15. MINIMUM WAGE RATES

In compliance with Massachusetts General Laws, Chapter 149, Sections 26 to 27H inclusive, job classifications and determinations of the rate of wages applying thereto have been established by the Department of Labor of the Commonwealth of Massachusetts and said job classifications and determinations of the rate of wages applicable to this Project are included at the end of this Article.

The Massachusetts Prevailing Wage Law
M.G.L. c. 149, §§26-27

NOTICE TO AWARDING AUTHORITIES

- The enclosed wage schedule applies only to the specific project listed at the top of the schedule, and these rates will remain in effect for the duration of the project, except in the case of multi-year projects. For projects lasting longer than one year, awarding authorities must request updated rates.
- You should request an updated wage schedule from the Division of Occupational Safety if you have not opened bids or selected a contractor within 90 days of the date of issuance of the enclosed wage schedule.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project for which it has been issued.
- Once a contractor has been selected by the awarding authority, the wage schedule shall be made a part of the contract for that project.

NOTICE TO CONTRACTORS

- The enclosed wage schedule must be posted in a conspicuous place at the work site during the life of the project.
- The wages listed on the enclosed wage schedule must be paid to employees on public works projects regardless of whether they are employed by the prime contractor, a filed sub-bidder, or any sub-contractor.
- The enclosed wage schedule applies to all phases of the project, including the final clean-up. Contractors whose only role is to perform final clean-up must pay their employees according to this wage schedule.
- All apprentices must be registered with the Massachusetts Division of Apprenticeship Training (DAT) in order to be paid at the lower apprentice rates. All apprentices must keep his/her apprentice identification card on his/her person during all work hours. If a worker is not registered with DAT, they must be paid the “total rate” listed on the wage schedule regardless of experience or skill level. For further information, please call 617-626-5409, or write to:
DAT, 19 Staniford Street, 1st Floor, P.O. Box 146759, Boston, MA 02114.

WEEKLY PAYROLL RECORDS REPORT
& STATEMENT OF COMPLIANCE

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

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

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

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 _____

DIVISION OF OCCUPATIONAL SAFETY, 19 STANIFORD STREET, 2nd FLOOR, BOSTON, MA 02114

MASSACHUSETTS WEEKLY CERTIFIED PAYROLL REPORT FORM

Company's Name:	Address:	Phone No.:	Payroll No.:

Employer's Signature:	Title:	Contract No:	Tax Payer ID No.	Work Week Ending:

Awarding Authority's Name:	Public Works Project Name:	Public Works Project Location:	Min. Wage Rate Sheet No.

General / Prime Contractor's Name:	Subcontractor's Name:

Employee Name & Complete Address	Employee is OSHA 10 Certified (?)	Work Classification:	Appr. Rate (%)	Hours Worked Su.	Mo.	Tu.	We.	Th.	Fr.	Sa.	Project Hours (A) / All Other Hours	Hourly Base Wage (B)	"Employer" Hourly Fringe Benefit Contributions: Health & Welfare Insurance (C)	ERISA Pension Plan (D)	Supp. Unemp. (E)	Total Hourly Prev. Wage (F) (B+C+D+E)	Project Gross Wages (G) (A x F) / Total Gross Wages	Check No. (H)
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NOTE: Pursuant to MGL Ch. 149 s.27B, every contractor and subcontractor is required to submit a "true and accurate" copy of their weekly payroll records directly to the awarding authority. Failure to comply may result in the commencement of a criminal action or the issuance of a civil citation.

Page _____ of _____

Date recieved by awarding authority
/ /

NOTICE: TO AWARDING AUTHORITIES AND CONTRACTORS CONCERNING THE REMOVAL AND APPLICATION OF PAINT ON BRIDGES AND TANKS
ISSUED: JANUARY 8, 2004

All awarding authorities and contractors are hereby notified that the "Painter (Bridges/Tanks)" occupational classification shall be used for the following tasks on public works construction projects covered by the prevailing wage law, Mass. G. L. c. 149, §§ 26 -27D: Painter (Bridges/Tanks)

- The erection and dismantling of scaffolding, rigging, and containment for bridge and tank painting operations.
- Surface preparation, including the removal of all types of paint, on bridges and tanks.
- The application of paint on bridges and tanks.
- The clean-up of debris resulting from paint removal operations on bridges and tanks.

This notice follows several applicability determinations issued by the Division of Occupational Safety (in response to several inquiries) and applies to all projects for which a prevailing wage schedule dated on or after January 8, 2004 has been issued.

Awarding authorities are encouraged to make this notice available to all contractors who may be engaged in projects involving the removal or application of paint on bridges and tanks.

All requirements of the prevailing wage law, including the submission of certified weekly payroll reports to awarding authorities, apply to workers engaged in these activities.

Copies of prior applicability determinations are available from the Division of Occupational Safety. If you have any questions concerning this matter, call 617-626-6953.

NOTICE: TO AWARDING AUTHORITIES AND CONTRACTORS
ISSUED: SEPTEMBER 1, 2006
DRIVERS WHO HAUL BITUMINOUS CONCRETE (ASPHALT)

The Massachusetts Supreme Judicial Court recently affirmed that drivers who haul bituminous concrete to public construction projects are not covered by the Prevailing Wage Law while off-site, including time spent over-the-road and picking-up materials. These drivers are covered by the Prevailing Wage Law only while on-site at the public construction project.

In Teamsters Joint Council No. 10 v. Department of Labor, et al., 447 Mass. 100 (2006), the SJC upheld a 2001 administrative decision limiting the applicability of prevailing wage rates to the time bituminous drivers spend at the public construction site. This most recent decision of the SJC followed a 1989 ruling that had upheld an earlier Department of Labor (and Industries') policy that had deemed this category of drivers to be "teamsters" under the Law and, therefore, entitled to prevailing wage rates. See Construction Industries of Massachusetts v. Commissioner of Labor and Industries, 406 Mass. 162 (1989). However, the earlier court case had left open the question of whether this entitled these bituminous drivers to prevailing wage rates for their over-the-road time as well as their on-site time. This most recent decision has now answered that question.

All of the requirements of the Prevailing Wage Law, including certified weekly payroll requirements, apply to bituminous drivers for all time spent at the public construction site.

DRIVERS WHO HAUL READY-MIX CONCRETE (CEMENT)
Drivers who haul ready-mix concrete to public construction projects are not covered by the Prevailing Wage Law while off-site, including time spent over-the-road and picking-up materials. These drivers are covered by the Prevailing Wage Law while on-site at the public construction project. This applicability determination was established by a 2001 administrative decision of the Department of Labor's Division of Occupational Safety.

All of the requirements of the Prevailing Wage Law, including certified weekly payroll requirements, apply to ready-mix drivers for all time spent at the public construction site.

Please feel free to contact the Division of Occupational Safety at 617-626-6953 if you have any questions. Questions about enforcement of the Prevailing Wage Law may be directed to the Attorney General's Fair Labor and Business Practices Division at 617-727-3465

Article 16. (NOTICE REQUIREMENTS FOR EXCAVATIONS IN PUBLIC WAYS)
(General Laws, Chapter 82, Sections 40-40E)

"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. 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.

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 designated its facilities as promptly as possible.

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 request 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 structure 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.

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 by 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.

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 $1,000 for the first offense and not less than $5,000 nor more than $10,000 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."

Article 17. (INVITATION TO BID; NOTICE; CONTENTS)
(General Laws, Chapter 149, Section 44J)

"Section 44J. (1) No public agency or authority of the commonwealth or any political subdivision thereof shall award any contract for which competitive bids are required pursuant to section forty-four A of this chapter or section thirty-nine M of chapter thirty, or for which competitive proposals are required pursuant to subsection (4) of section forty-four E of this chapter or section eleven C of chapter twenty-five A, unless a notice inviting bids or proposals therefor shall have been posted no less than one week prior to the time specified in such notice for the receipt of said bids or proposals in a conspicuous place in or near the offices of the awarding authority, and shall have remained posted until the time so specified, and unless such notice shall also have been published at least once not less than two weeks prior to the time so specified in the central register published by the secretary of state pursuant to section twenty A of chapter nine and in a newspaper of general circulation in the location of the proposed project. Said notice shall

also be published at such other times and in such other newspapers or trade periodicals as the commissioner of capital asset management and maintenance may require, having regard to the locality of the work involved.

(2) Said notice shall specify the time and place where place and specifications of the proposed work may be had; the time and place of submission of general bids; and the time and place for opening of the general bids. For contracts subject to the provisions of sections forty-four A to H, inclusive, of this chapter, said notice shall also specify the time and place for submission of filed subbids, where required pursuant to section forty-four F; and the time and place for opening of said filed subbids.

Said notice shall also provide sufficient facts concerning the nature and scope of each project, the type and elements of construction, and such other information as will assist applicants in deciding to bid on such contract."

Article 18. (PLANS AND SPECIFICATIONS; SUBBIDS; FORM; CONTENTS)
(General Laws, Chapter 149, Section 44F)

"(1)(a) Every contract subject to section forty-four A shall include specifications and, if deemed necessary or convenient by the awarding authority, plans, detailing all labor and materials to be furnished thereunder. Such specifications shall have a separate section for each of the following classes of work if in the estimate of the awarding authority such class of work will exceed $20,000: (a) roofing and flashing; (b) metal windows; (c) waterproofing, damp-proofing and caulking; (d) miscellaneous and ornamental iron; (e) lathing and plastering; (f) acoustical tile; (g) marble; (h) tile; (i) terrazzo; (j) resilient floors, (k) glass and glazing; (l) painting; (m) plumbing; (n) heating, ventilating and air conditioning; (o) electrical work, including direct electrical radiation for heating; (p) elevators; (q) masonry work; and (r) any other class of work for which the awarding authority deems it necessary or convenient to receive subbids, provided that the awarding authority may, in addition, receive a combined subbid on the marble, tile and terrazzo work, but in that event, the marble, tile and terrazzo work shall each be a class of work for which the subbidder must list the information in a clearly designated place on the bid form for that purpose. Each separate section in the specifications prescribed or provided for by this paragraph shall state the time limit for filing subbids with the awarding authority, shall specify by number each sheet of plans showing work to be done by the subcontractor under such section, and shall require the subcontractor to install all materials to be furnished by him under such section other than materials which in the opinion of the awarding authority it is not customary under then current trade practices for such subcontractor to install and the installation of which is expressly required by another section of the specifications. Each class of work set forth in a separate section of the specifications pursuant to this section shall be a sub-trade designated in the appropriate category of the general bid form and shall be the matter of subcontract made on the basis of subbids in accordance with the procedure set forth in sections forty-four F(1)-(5).

Each separate section of the specifications required by the provisions of this section shall contain a paragraph describing by class of work and by reference to paragraph numbers in that section, each class of work, if any, requiring labor and materials which, in the opinion of the awarding authority based upon an investigation of the work involved, is customarily performed in that sub-trade under subcontract with a subbidder for that sub-trade, and which is estimated by the awarding authority to cost in excess of ten thousand dollars, and only each class of work so described shall be a class of work for which subbidder for that sub-trade must list the information required in the appropriate place designated on the bid form for that purpose.

Every contract subject to section forty-four A shall include specifications for the installation of weather protection and shall require that the general contractor shall install the same and that he shall furnish adequate heat in the area so protected during the months of November through March. Standards for such specifications shall be established by the commissioner of planning and operations in the executive office for administration and finance.

(2) Every subbid submitted in connection with a contract subject to section forty-four A for a sub-trade designated in item 2 of the general bid form pursuant to section forty-four E shall be submitted on a form furnished by the awarding authority and containing the following provisions:

FORM FOR SUBBID

To all General Bidders Except those Excluded:

A. The undersigned proposes to furnish all labor and materials required for completing, in accordance with the hereinafter described plans, specifications and addenda, all the work specified in Section No. ___ ___ of the specifications and in any plans specified in such section, prepared by _____ ___ for _____ in
(name of architect or engineer) (project)

_____, Massachusetts, for the contract
(city or town)

sum of _____ dollars ($_____).

For Alternate No._____; Add $_____ Subcontract $_____

[Repeat preceding line for each alternate]

B. This subbid includes addenda numbered _____

C. This subbid

☐ may be used by any general bidder except:

_____

_____

☐ may only be used by the following general bidders:

_____

_____

[To exclude general bidders, insert "X" in one box only and fill in blank following that box. Do not answer C if no general bidders are excluded.]

D. The undersigned agrees that, if he is selected as a subbidder, he will, within 5 days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, execute with such general bidder a subcontract in accordance with the terms of this subbid, and contingent upon the execution of the general contract, and, if requested so to do in the general bid by the general bidder, who shall pay the premiums therefore, or if prequalification is required pursuant to section 44D 3/4, furnish a performance and payment bond of a surety company qualified to do business under the laws of the commonwealth and satisfactory to the awarding authority, in the full sum of the subcontract price.

E. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work for which the provisions of the section of the specifications for this sub-trade require a listing in this paragraph, including the undersigned if customarily furnished by persons on his own payroll and in the absence of a contrary provision in the specifications, the name of each such class of work or part thereto and the bid price for such class of work or part thereof are:

Name	Class of Work	Bid Price

[Do not give bid price for any class or part thereof furnished by undersigned.]

F. The undersigned agrees that the above list of bids to the undersigned represents bona fide bids based on the hereinbefore described plans, specifications and addenda and that, if the undersigned is awarded the contract, they will be used for the work indicated at the amounts stated, if satisfactory to the awarding authority.

G. The undersigned further agrees to be bound to the general contractor by the terms of the hereinbefore described plans, specifications, including all general conditions stated therein, and addenda, and to assume toward him all the obligations and responsibilities that he, by those documents, assumes toward the owner.

H. The undersigned offers the following information as evidence of his qualifications to perform the work as bid upon according to all the requirements of the pans and specifications:

1. Have been in business under present business name _____ years.

2. Ever failed to complete any work awarded? _____

3. List one or more recent buildings with names of the general contractor and architect on which you served as a subcontractor for work of similar character as required for the above-named building.

	Building	Architect	General Contractor	Amount of Contract
(a)				
(b)				
(c)				

4. Bank Reference _____

I. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that he will comply fully with all laws and regulations applicable to awards of subcontractors subject to section forty-four F.

The undersigned further certifies under penalties of perjury that this subbid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. 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 provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

Date: _____

_____
(Name of Subbidder)

By _____
(Title and Name of Person Signing Bid)

_____
(Business Address)

_____
(City and State)

(3) Every subbid in connection with a contract subject to section forty-four A for a sub-trade designated on the general bid form pursuant to section forty-four F(2) shall be for the complete work of the sub-trade as specified, and shall be filed with the awarding authority, in a sealed envelope, before twelve o'clock noon at least four days, Saturdays, Sundays and legal holidays excluded, before the day fixed by the awarding authority for the opening of general bids, and forthwith after the time limit for the filing thereof shall be publicly opened and read by the awarding authority, which, within two days thereafter, Saturdays, Sundays and legal holidays excluded, shall reject every subbid which is not accompanied by a bid deposit as prescribed in sub-section (2) of section forty-four B, or which otherwise does not conform with sections forty-four A to forty-four H, inclusive, or which is on a form not completely filled in, or which is incomplete, conditional or obscure, or which contains any addition not called for; provided, however, that the failure of the awarding authority to reject such a subbid within such period shall not validate such a subbid nor preclude the awarding authority from subsequently rejecting it. Not later than the second day, Saturdays, Sundays and legal holidays excluded, before the day fixed by the awarding authority for the opening of general bids, the awarding authority shall mail to every person on record as having taken a set of plans and specifications list of subbidders arranged by sub-trades and listing for each sub-trade the name, address and subbid price of every subbidder submitting a subbid thereon not rejected by the awarding authority and the general bidders excluded from using such subbid. A person shall not be named by a general bidder as a subbidder for a sub-trade on the general bid form unless such person is included for such sub-trade in said list. If a general bidder not excluded in said list from doing so names as a subbidder for a subtrade on the general bid form a person included for such sub-trade in said list at the subbid price stated in said list, neither the general bid of such general bidder nor the general contract executed on the basis of such general bid shall be invalid or rejected because of the invalidity of such subbid, or because of error in said list, nor shall such general bid be rejected nor shall such general contract be invalid because of any invalid action taken by the awarding authority in connection with any subbid or subbids; but there shall be substitution of subbidders and adjustment of contract price as if paragraph (c) of section forty-four F (4) were applicable. No subbid shall be rejected because of the failure to submit prices for or information relating to, any item or items for which no space is provided in

the subbid form furnished by the awarding authority; but this sentence shall not be applicable to any failure to furnish prices or information required by section forty-four F to be furnished in the Form for SubBid.

Every subbidder duly filing a subbid with the awarding authority as aforesaid shall be bound thereby to every general bidder not excluded therein from the use thereof; and any variance from such subbid communicated to a general bidder shall be of no effect.

A performance and payment bond furnished by the subcontractor, either pursuant to the requirements of the prequalification process as established in section 44D ¾ or at the request of a general contractor set forth in the general bid form, shall be for the benefit of the general contractor; shall secure the performance of the subcontract by the subcontractor; and shall indemnify and hold harmless the general contractor and the surety or sureties under the labor and materials or payment bond furnished by the general contractor to the awarding authority against (i) any and all loss and expense arising out of any and all claims in connection with the performance of the subcontract which would be required to be paid under the labor and materials or payment bond furnished by the general contractor to the awarding authority and (ii) attorneys' fees in the event that the subcontractor, after notice, fails to assume the defense of and defend such claims.

Each subbidder shall list in the subbid form the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the section of the specifications for that sub-trade requires such listing; provided that, in the absence of a contrary provision in the specifications, any subbidder may, without listing any bid price, list his own name for any such class of work or part thereof and perform that work with persons on his own payroll, if such subbidder, after subbid opening, shows to the satisfaction of the awarding authority that he does customarily perform such class of work or the part thereof with employees on his own payroll who are mechanics or laborers as referred to in section twenty-six, and is qualified so to do.

If a sub-trade for which the awarding authority is required to take filed subbids constitutes the predominant work of the contract, the awarding authority may include that sub-trade work as part of the general bidder's work. The awarding authority shall award the general contract to the lowest responsible and eligible bidder who customarily performs that sub-trade with employees on his own payroll who are mechanics or laborers as referred to in said section twenty-six, except for any part of that sub-trade customarily performed by sub-contractors.

(4) (a) (1) If no subbid is filed for a sub-trade designated in the general bid form or if the only subbids which are filed are restricted to the use of one or more general bidders, the awarding authority may state, in an addendum issued with the list of subbidders required by subsection (3), that the general bidder shall include in the cost of his own work an amount to cover all the work required for any such sub-trade. The general contractor shall cause the work covered by such sub-trade to be done by a qualified and responsible sub-contractor, subject to the written approval of the awarding authority. If the awarding authority determines that any sub-contractor chosen by the general contractor under this section is not qualified or responsible, the general contractor shall obtain another sub-contractor who is satisfactory to the awarding authority with no adjustment in the general contractor's price.

(2) If a rejection of all subbids, other than as set forth above, for such a sub-trade occurs pursuant to subsection (1) of section forty-four E or subsection (3) of this section, the awarding authority shall state, in an addendum issued with the list of subbidders required by said subsection (3), the amount to be included by a general bidder on the general bid form for such sub-trade; and without in any way affecting other subbidders who have conformed to the prescribed bidding procedure, new subbids for such sub-trade shall be requested forthwith by written invitation to three or more qualified subbidders and shall be publicly

opened and read by the awarding authority at a time and place to be specified in such invitation. The general contractor shall cause the work covered by such sub-trade to be done by the lowest responsible and eligible subbidder against whose standing and ability the general contractor makes no objection or, if there is no such subbidder, by such sub-contractor against whose standing and ability the general contractor makes no objection and for such sum as the general contractor and the awarding authority may agree upon; and the contract price shall be adjusted by the difference between the sub-contract sum and the amount stated in the addendum. The general bidder shall include in the cost of his own work on the general bid form all expenses and profits on account of such adjustments.

(b) If, after the selection of the lowest responsible and eligible general bidder, it be decided to consider subbidders other than the ones named by such general bidder in his general bid, the awarding authority and such general bidder shall jointly consider all filed subbids not rejected under section forty-four F(3). Any agreement to substitute a subbid for the one named in the selected general bid shall result in an adjustment of the general bid price by the difference between the amount of the subbid originally named and the amount of the subbid substituted therefor. If by such substitutions the total adjusted general bid price of the general bidder first selected becomes greater than the original general bid price of the second lowest responsible and eligible general bidder, then the latter shall be selected and his subbidders similarly considered. If, by substitutions as hereinbefore provided, the total adjusted general bid price of the second selected general bidder becomes greater than the total adjusted general bid price of the general bidder first selected or greater than the original general bid price of the third lowest responsible and eligible general bidder, then the bidder having the lower of these two general bid prices shall be selected; provided, that if the third lowest responsible and eligible general bidder is selected, his subbidders shall be similarly considered. The general bidder finally selected by the aforementioned process of substitutions shall be the general bidder to whom the contract shall be awarded.

(c) If a selected subbidder fails, within 5 days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, to perform his agreement to execute a subcontract in the form hereinafter set forth with such general bidder, contingent upon the execution of the general contract, and, if required to do so pursuant to the prequalification process under section 44D ¾ or if requested to do so by such general bidder in the general bid, to furnish a performance and payment bond as stated in his subbid such general bidder and the awarding authority shall select, from the other subbids duly filed with the awarding authority for such sub-trade and not rejected under section 44H the lowest responsible and eligible subbidder at the amount named in his subbid as so filed against whose standing and ability the general contractor makes no objection, and the contract price shall be adjusted by the difference between the amount of the subbid and the amount of the subbid of the delinquent subbidder.

The subcontract shall be in the following form:

SUBCONTRACT

THIS AGREEMENT MADE THIS _____ DAY OF_____, by and between
(insert year)
_____ a corporation organized and existing under the laws of _____ an individual doing business as _____ herein after called the "Contractor" and _____ a corporation organized and existing under the laws of _____ an individual doing business as _____ hereinafter called the "Subcontractor". WITNESSETH that the Contractor and the Subcontractor for the considerations hereafter named, agree as follows:

1. The Subcontractor agrees to furnish all labor and materials required for the completion of all work specified in Section No. _____of the specifications for _____ and the plans referred to therein and addenda No. _____,
(Name and Sub-Trade)
_____, _____, and _____ for the

_____

_____

(complete title of the project and the project number taken from the title page of the specifications) all as prepared by _____
(Name of Architect or Engineer)
for the sum of _____ ($_____) and the Contractor agrees to pay the Subcontractor said sum for said work. This price includes the following alternates (and other items set forth in the subbid): Alternate No(s). _____, _____, _____, _____, _____, _____, _____, _____, _____, _____, _____

(a) The Subcontractor agrees to be bound to the Contractor by the terms of the hereinbefore described plans; specifications (including all general conditions stated therein) and addenda No. _____, and _____, and _____, and to assume to the Contractor all the obligations and responsibilities that the Contractor by those documents assumes to the _____
(Awarding Authority)

hereinafter called the "Awarding Authority", except to the extent that provisions contained therein are by their terms or by law applicable only to the Contractor.

(b) The Contractor agrees to be bound to the Subcontractor by the terms of the hereinbefore described documents and to assume to the Subcontractor all the obligations and responsibilities that the Awarding Authority by the terms of the hereinbefore described documents assumes to the Contractor, except to the extent that provisions contained therein are by their terms or by law applicable only to the Awarding Authority.

2. The Contractor agrees to begin, prosecute and complete the entire work specified by the Awarding Authority in an orderly manner so that the Subcontractor will be able to begin, prosecute and complete the work described in this subcontract; and in consideration thereof, upon notice from the Contractor, either oral or in writing, the Subcontractor agrees to begin, prosecute and complete the work described in this Subcontract in an orderly manner and with due consideration to the date or time specified by the Awarding Authority for the completion of the entire work.

3. The Subcontractor agrees to furnish to the Contractor within a reasonable time after the execution of this subcontract, evidence of workers' compensation insurance as required by law and evidence of public liability and property damage insurance of the type and in limits required to be furnished to the Awarding Authority by the Contractor.

4. The Contractor agrees that no claim for services rendered or materials furnished by the Contractor to the Subcontractor shall be valid unless written notice thereof is given by the Contractor to the Subcontractor during the first ten (10) days of the calendar month following that in which the claim originated.

5. This agreement is contingent upon the execution of a general contract between the Contractor and the Awarding Authority for the complete work.

IN WITNESS WHEREOF, the parties hereto have executed this agreement the date and year first above-written.

SEAL ATTEST _____ _____
(Name of Subcontractor)

By _____

SEAL ATTEST _____ _____
(Name of Contractor)

By _____

In the event that the contract between the general contractor and the awarding authority does not contain provisions granting to the awarding authority the right to terminate the general contract when the general contractor encounters financial difficulties or fails to make satisfactory progress, the general contractor may insert the following paragraph:

If the Subcontractor should be adjudged a bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he should persistently or repeatedly refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials, or if he should fail to make prompt payment to subcontractors or for material or labor, or persistently disregard laws, ordinances or the instructions of the Contractor, or otherwise be guilty of a substantial violation of any provision of the contract, then the Contractor may, without prejudice to any other right or remedy and after giving the Subcontractor and his surety, if any, seven days' written notice, terminate the employment of the Subcontractor and take possession of the premises and of all materials, tools and appliances thereon and finish the work by whatever method he may deem expedient. In such case the Subcontractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the contract price shall exceed the expense of finishing the work including compensation for additional architectural, managerial and

administrative services, such excess shall be paid to the Subcontractor. If such expense shall exceed such unpaid balance, the Subcontractor shall pay the difference to the Contractor.

The contractor and subcontractor shall have the right to seek damages for breach of a subcontract without terminating the subcontract or ceasing performance thereunder.

All subbidders when finally selected shall be notified in writing of their selection within forty-eight hours thereafter by the general bidder.

In each case of substitution of a subbidder for a subbidder listed in the general bid of the selected general contractor, the selected general contractor may require the substituted subbidder to furnish a performance and payment bond, and the premiums for same shall be added to the general bidder's price for work to be performed by him except where the selected general contractor had indicated in his general bid that the original subbidder designated for that sub-trade, in which substitution was made, would be required to furnish such bond.

In the instances enumerated in paragraphs (1), (2) and (3) of this section, the general bidder's price for work to be performed by him shall also be adjusted by the amount of the change in the premium for the general contractor's performance bond and his labor and materials or payment bond caused by the substitution.

(5) If a general bidder customarily performs, with employees on his own payroll who are mechanics or laborers as referred to in section twenty-six, a sub-trade for which the awarding authority invites subbids, he may submit a subbid for such sub-trade which shall be considered on a par with other subbids, and he shall also list under the appropriate subbid category in his general bid his own name and subbid price for such sub-trade. No such subbid shall be considered unless the general bidder can show (a) he does so customarily perform such sub-trade, and (b) he is qualified to do the sub-trade work.

In lieu of listing his name and subbid price in his general bid, such general bidder may list the name and amount of the lowest responsible and eligible subbidder for that sub-trade if (a) such subbidder's price is lower than his, (b) such subbid is available for his use; and (c) such subbid is not restricted to his use alone or to his use and that of another general bidder, or bidders."

Article 19. (ALLOWANCES; ALTERNATES; WEATHER PROTECTION DEVICES)
(General Laws, Chapter 149, Section 44G)

"(A) "Allowance" as used herein means a sum of money covering one or more items of labor or labor and materials which is designated in bid documents and which general bidders are required to use in computing their bids. The use of such allowances shall be prohibited in the award of any contract subject to the provisions of section forty-four A. Whenever the designer is unable to supply specifications for any item prior to the solicitation of bids, such item shall not be included in any contract subject to the provisions of section forty-four A. The awarding authority shall solicit bids for every such item separately pursuant to the provisions of section forty-four A after specifications for that item are prepared.

B. Every alternate contained in the form for general bids shall be listed in a numerical sequence in order of priority. When the awarding authority decides to consider alternates in determining the lowest eligible and responsible bidder, the awarding authority shall consider the alternates in descending numerical sequence, such that no single alternate shall be considered unless every alternate preceding it on the list has been added to or subtracted from the base bid price.

C. The use of options other than alternates in bid documents or bid forms subject to section forty-four A shall be prohibited under all circumstances.

D. Every contract subject to section forty-four A shall include specifications for the installation of weather protection and shall require that the contractor shall install the same and that he shall furnish adequate heat in the area so protected during the months of November through March. Standards for such specifications shall be established by the commissioner or his designee."

END OF DOCUMENT

DOCUMENT 00858

SPECIAL CONDITIONS

PERMITS AND LICENSES

1.01 LIST OF PERMITS AND/OR LICENSES

A. Massachusetts Department of Transportation Permit (attached)

B. Utility Coordination and Requirements

Contractor shall be responsible for contacting and coordinating with utility companies prior to commencing work in the area of utilities. Special requirements may be necessary for work in the vicinity of some utilities and easements. Requirements may include but are not limited to the following; surface marking of crossings and easements, temporary fencing, temporary pipe support, additional padding or steel plates for heavy equipment, and coordination with utility field personnel. Guidelines provided by NSTAR and Spectra Energy are attached to this specification.

C. EPA Construction General Permit

- EPA electronic Notice of Intent (eNOI)

  Contractor shall be responsible for preparing and submitting an EPA Notice or Intent (NOI) through the EPA's electronic NOI system (eNOI).

- Stormwater Pollution Prevention Plan (SWPPP)

  Contractor shall responsible for creating the required SWPPP and updating this document as necessary to reflect changes.

Additional information on obtaining a CGP can be found at the links provided below.

http://water.epa.gov/polwaste/npdes/stormwater/Applying-for-Coverage-under-the-Construction-General-Permit-CGP.cfm

http://water.epa.gov/polwaste/npdes/stormwater/upload/cgp2012_finalfactsheet.pdf

END OF DOCUMENT

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION

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DEPT. OF PUBLIC WORKS
PLYMOUTH, MA

massDOT
Highway Division

Permit #: 5-2014-0473

PERMIT - PLYMOUTH

Subject to all terms, conditions, and restrictions printed, attached or written below, and on the reverse side hereof, permission is hereby granted to the TOWN OF PLYMOUTH DPW, Jonathan Beder, 159 Camelot Drive, Plymouth, MA 02360 to enter upon the State Highway in the Town of PLYMOUTH on Samoset Street, for the purpose of installing approximately 200 linear feet of sewer force main and one (1) manhole within the State Highway Layout.

This work is part of the Samoset Street Sewer System Expansion project where the majority of the work will be performed on Town roads.

Work within the State Highway Layout includes the installation of an 8" (inch) gravity sewer main and one (1) manhole. The 8-inch gravity sewer main installation will enter the State Highway Layout on the northerly side of the road at approximate Station 17+60. The main will proceed easterly through an open cut trench along Samoset Street (northerly travel lane) to Station 20+00 and will proceed northerly and out of the State Highway Layout.

One (1) sewer manhole (SMH-15) will be installed on the southerly side of the road at the intersection of Samoset Street and Myles Standish Plaza driveway entrance at approximate Station 20+20.

IT IS NOTED THAT THE LONGITUDINAL SEWER MAIN IS WITHIN THE TRAVEL LANE AND WILL IMPACT THE TRAVEL PATH OF MOTORISTS, THE PERMANENT REPAIR OF THE TRENCH MUST INCLUDE MILLING AND OVERLAYING THE FULL WIDTH OF PAVEMENT. THE REQUIRED THICKNESS OF MILL/OVERLAY SHALL BE TWO INCHES (2"). THE PERMANENT REPAIR OF THE TRENCH, INCLUDING THE MILLING AND OVERLAYING MUST BE DONE AFTER COMPLETION OF THE 90-DAY SETTLEMENT PERIOD AS DESCRIBED IN THIS PERMIT.

The permanent trench repair shall be done as indicated below. Please note that the final trench repair must include a minimum of seven inches (7") of Hot Mix Asphalt or match the existing thickness of the Hot Mix Asphalt for the roadway, whichever is larger.

1. 8" of gravel plus 4" Dense Graded Crushed Stone (DGCS) over it.
2. 3" Binder or Base Course
3. 2" Binder Course
4. 2" Modified Top Course
5. Tack Vertical pavement edges with RS-1 Emulsion
6. All damaged pavement markings shall be restriped.

A THREE-YEAR PERFORMANCE BOND FOR THE AMOUNT OF $194,220.00 IS REQUIRED BEFORE CONSTRUCTION STARTS.

"FOLLOWING CONDITIONS APPLY TO PERMITS"

Conditions Relating Particularly to Permits for the Laying of Pipes, Conduits, etc.

After any pipes, conduits, drains or other underground structures are laid, or any excavation is made in the roadway, the trenches or openings shall be properly backfilled with suitable material, the back-filling shall be thoroughly tamped, and the surface of the road over said structures shall be left even with the adjoining ground. If the work is done in cold weather no frozen material shall be used for back-filling.

Wherever the hardened surface of the roadway, gutters, or any part of the surface of the highway is disturbed it shall be replaced in as good condition as before it was disturbed, and if new materials are required they shall correspond with those already in place on the road.

Where service pipes are to cross the highway the connections shall be made without disturbing the hardened surface of the roadway, by driving the pipes under the roadway, or the service pipes shall be carried under and across the road in a larger pipe, unless otherwise ordered by the Director.

The Grantee shall maintain the surface of the roadway over said structures as long as MassDOT may deem necessary, until all signs of the trenches shall have been eliminated.

Conditions Relating Particularly to Permits for the Erection of Poles, Wires, and Overhead Structures, and the Cutting and Trimming of Trees

In the erection of pole lines, unless otherwise herein provided, no trees located within the limits of the State Highway shall be cut or trimmed. No guy wires shall be attached to trees without a special permit from MassDOT, and in no event shall they be so attached as to girdle the trees or in any way interfere with their growth. The wires shall be so protected at all time and places that they shall not interfere with or injure the trees either inside or outside the location of the highway.

Where the cutting or trimming of trees is authorized by this permit, only such cutting and trimming shall be done as may be designated by the Director.

In the construction or reconstruction of pole lines no guy wires shall be erected nearer to the surface of the ground than six feet; provided, however, that the owners of such lines may maintain such guy wires at a lower elevation than six feet from the ground until such time as MassDOT shall notify them to remove said wires or to the elevation first stated.

In order to protect the trees through which any wires may pass, said wires shall be insulated and such other tree guards used as may be directed by the Director.

Where high tension wires are erected under this permit, they shall be so located that, under conditions of maximum severity as regards a coating of ice or snow, there shall be a space of at least eight feet between such high tension wires and other wires.

The Grantee shall, within sixty days from the date of completion of the work, file in the office of MassDOT a plan showing the location of each pole erected in accordance with the permit, said plan to be of such size and in such form as MassDOT may direct.

General and Additional Conditions

Whenever the word "MassDOT" is used herein it shall mean the Massachusetts Department of Transportation of the Commonwealth of Massachusetts.

Whenever the word "Director" is used herein it shall mean the District Highway Director or other authorized representative of MassDOT.

Whenever the word "Grantee" is used herein it shall mean the person or persons, corporation or municipality to whom this permit is granted, or their legal representatives.

During the progress of the work all structures under ground and above ground shall be properly protected from damage or injury; such barriers shall be erected and maintained as may be necessary for the protection of the traveling public; the same shall be properly lighted at night; and the Grantee shall be responsible for the damages to persons or property due to or resulting from any work done under this permit.

Except as herein authorized, no excavation shall be made or obstacle placed within the limits of the State highways in such a manner as to interfere unnecessarily with the travel over said road.

If any grading of sidewalk work done under this permit interferes with the drainage of the State highway in any way, such catch basins and outlets shall be constructed as may be necessary, in the opinion of the Director, to take proper care of such drainage.

Wherever the hardened surface of the roadway is disturbed and the Director may consider it necessary or advisable to do so, said surface will be restored by the employees of MassDOT, at such time as MassDOT may direct, and the expense thereof shall be borne by the Grantee, who shall purchase and deliver on the road the materials necessary for said work if and when directed by the Director. All payments to the supplier and to laborers, inspectors, etc., employed by MassDOT for or on account of the work herein contemplated shall be made by said Grantee forthwith on receipt of written orders, pay rolls, or vouchers approved by MassDOT.

IF THE GRANTEE DOES ANY WORK CONTRARY TO THE ORDERS OF THE DIRECTOR, AND, AFTER DUE NOTICE, FAILS TO CORRECT SUCH WORK OR TO REMOVE STRUCTURES OR MATERIALS ORDERED TO BE REMOVED, OR FAILS TO COMPLETE WITHIN THE SPECIFIED TIME THE WORK AUTHORIZED BY THIS PERMIT, MASSDOT MAY, WITH OR WITHOUT NOTICE, CORRECT OR COMPLETE SUCH WORK IN WHOLE OR IN PART, OR REMOVE SUCH STRUCTURES OR MATERIALS, AND THE GRANTEE SHALL REIMBURSE MASSDOT FOR ANY EXPENSE INCURRED IN CORRECTING AND/OR COMPLETING THE WORK OR REMOVING THE STRUCTURES OR MATERIALS.

ALL OF THE WORK HEREIN CONTEMPLATED SHALL BE DONE UNDER THE SUPERVISION AND TO THE SATISFACTION OF THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, AND THE ENTIRE EXPENSE THEREOF SHALL BE BORNE BY THE GRANTEE.

On the completion of the work herein contemplated all rubbish and debris shall be removed and the roadway and roadsides shall be left neat and presentable and satisfactory to the Director.

MassDOT hereby reserves the right to order the change of location or the removal of any structure or structures authorized by this permit at any time, said change or removal to be made by and at the expense of the Grantee or its / their successors or assigns.

This permit may be modified or revoked at any time by MassDOT without rendering said MassDOT or the Commonwealth of Massachusetts liable in any way.

The Grantee shall pay the salary, subsistence and travel expenses of any inspector appointed by MassDOT to supervise the work herein contemplated.

All of the above conditions shall be applicable to the work herein authorized, unless the same are inconsistent with the conditions on the face of the permit, in which case the conditions written or printed on the face of the permit shall apply.

The acceptance of this permit or the doing of any work thereunder shall constitute an agreement by the Grantee to comply with all of the conditions and restrictions printed or written herein.

THIS WORK MUST BE DONE BEFORE AND IN COORDINATION WITH MASSDOT HIGHWAY DIVISION'S PLYMOUTH - RECONSTRUCTION OF ROUTE 44 (SAMOSET STREET) FROM ROUTE 3 (NB RAMP) EASTERLY TO WATER STREET PROJECT. PLEASE CONTACT THE STATE RESIDENT ENGINEER, DANIEL MASTRANGELO AT 774-292-2086 TO COORDINATE THIS WORK. FURTHERMORE, IF ANY SETTLEMENT IS ENCOUNTERED ON THE ROADWAY DUE TO THIS WORK AND AFTER IMPROVEMENTS ON THE ROADWAY BY MASSDOT, HIGHWAY DIVISION, THE GRANTEE WILL BE RESPONSIBLE TO PERFORM REPAIR OF THE TRENCH PLUS MILLING AND OVERLAYING THE ENTIRE SECTION OF SAMOSET STREET (CURB TO CURB).

ADDITIONALLY, THE WORK FOR THIS PERMIT MUST BE DONE IN COORDINATION WITH NSTAR GAS COMPANY, PERMIT #5-2013-0317. PLEASE CONTACT JOHN LESKOW AT (339) 987-8542 TO COORDINATE THIS WORK.

BEFORE ANY WORK IS TO BE DONE WITHIN THE STATE HIGHWAY LAYOUT THE GRANTEE(S) MUST CALL THE DISTRICT PERMIT ENGINEER AT (508) 884-4306, SO THAT THE PROPOSED WORK SCHEDULE CAN BE APPROVED. THE GRANTEE MUST CONTINUE TO CONTACT THE DISTRICT THROUGHOUT THE PROJECT DURATION ON A WEEKLY BASIS, BY THE CLOSE OF BUSINESS ON THURSDAY TO REQUEST THE FOLLOWING WEEK'S PROPOSED WORK SCHEDULE.

THE GRANTEE(S) MUST ADHERE TO 520 CMR 14.00: EXCAVATION AND TRENCH SAFETY AS PROMULGATED BY THE DEPARTMENT OF PUBLIC SAFETY IN CONJUNCTION WITH THE DIVISION OF OCCUPATIONAL SAFETY PURSUANT TO AUTHORITY GRANTED BY M.G.L. c. 82A § 1. IF NOT ALREADYAPPROVED, THE ATTACHED TRENCH PERMIT RIDER MUST BE COMPLETED AND SUBMITTED TO MASSDOT, HIGHWAY DIVISION, BEFORE ANY TRENCH WORK IS PERFORMED UNDER THIS PERMIT.

All work, including the traffic management plan, is to be done as described herein and as shown on the plan(s) entitled "Town of Plymouth, MA Contract No. 2014-PH1, Samoset Street Sewer System Expansion" as drafted by AECOM Technical Services, Inc., 250 Apollo Drive, Chelmsford, MA 01824, tel.: (978) 905-2100, and dated July 2014.

IF THE PROPOSED WORK FALLS WITHIN THE AREA OF A SIGNALIZED INTERSECTION, the Grantee(s) must contact the District Traffic Maintenance Engineer at (508) 884-4208 at least two business days prior to the commencement of said work to locate the existing traffic signal conduit/detectors and to coordinate this work so as not to disturb the traffic signals. The Grantee(s) will be responsible to repair/replace all damaged items and signal equipment, and will be billed for any cost incurred to restore normal operation to MassDOT, Highway Division.

PRIOR TO THE COMMENCEMENT OF SAID WORK, THE GRANTEE(S) SHALL CONTACT THE DISTRICT PERMITS ENGINEER AT (508) 884-4211 TO SET UP A PRECONSTRUCTION CONFERENCE. THE CONFERENCE MUST BE HELD AT LEAST FIVE (5) BUSINESS DAYS PRIOR TO PERFORMING WORK WITHIN THE S.H.L.O.

Request for changes to the terms and conditions described within this Permit, must be submitted in writing and approved by MassDOT, Highway Division, by way of an amendment to this Permit or via correspondence to the Grantee(s) prior to the commencement of any proposed changes.

The Grantee(s) may retain the services of a qualified engineering firm to provide for the continuous inspection of the work to be performed under this permit by a full time Resident Engineer or a qualified on-site Supervisor. The Grantee(s) shall notify MassDOT, Highway Division, in writing as to what consulting firm/supervisor will be used. Included in this notification, a list of 24 hour emergency contact names and numbers of all pertinent parties responsible for the project. The on-site supervisor must coordinate any design changes and/or problems with the District Highway Director who will assign the proper personnel to expedite these issues.

When the work required under this Permit has been completed, the Grantee(s)/Supervisor shall conduct their own inspection prior to contacting MassDOT, Highway Division, to schedule a Final Inspection. Once this pre-inspection is performed, the inspector will contact the Permits Section at (508) 884-4306 in order for a Final Inspection to be performed by MassDOT, Highway Division.

CONTROLLED DENSITY FILL (CDF) WAIVER

At the written request of the Grantee(s) and approval from MassDOT, Highway Division, CDF is NOT required on this project for trenches greater than 48" in depth. The Grantee(s) shall perform the work for conventional backfill methods as follows:

1. All methods used to determine and verify the proper compaction of backfill shall be in accordance with AASHTO Standard Specifications of Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth) (Designation T238-86 Method B - Direct Transmission shall be used to determine in-place density) and Moisture Content of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth) (Designation T239-91). Backfill material shall be in accordance with MassDOT, Highway Division Standard Specifications, Section 150.64, Subsection C.

All methods and work shall be performed by a technician on location certified in "soils" by the New England Transportation Technician Certification Program (NETTCP). All data and results shall be submitted to the appropriate District Highway Director for its review and acceptance.

2. The Performance Bond in the amount of $194,220.00 is required by the Grantee(s) to warranty the work described in this waiver. The life of the Performance Bond shall be three (3) years from the date MassDOT, Highway Division, receives the Completion of Work Form.

The Performance Bond shall be in a form satisfactory to MassDOT, Highway Division, furnished by a surety company incorporated pursuant to M.G.L. chapter 175, section 105 or authorized to do business in the Commonwealth under M.G.L. Chapter 175, section 106 and satisfactory to the awarding authority. The name of the agency or agent writing these bonds shall be identified within the bond.

3. The Completion of Work Form shall be sent to MassDOT, Highway Division, via certified mail as soon as possible after the completion of the physical work. MassDOT, Highway Division, will hold the Permit on file for a period of not less than three (3) years.

4. The Grantee(s) shall assume full responsibility for the structural integrity of any trench described in this Permit. This responsibility shall remain in place for a period of three (3) years after the completion of work which time starts with MassDOT, Highway Division, receiving the Completion of Work Form.

The Grantee(s) shall supply MassDOT, Highway Division with 24 hour emergency contact numbers and immediately respond to trench maintenance requests by the District Highway Director. The Grantee(s) must respond within two (2) working days for non-emergency situations. Non-response within the specified time will result in the required maintenance work being done by MassDOT, Highway Division, with all expenses charged to the Grantee(s).

5. Supplying, positioning, adjusting and re-positioning of all required signs and traffic warning devices shall be the responsibility of the Grantee(s). All signs and devices shall be in accordance with the current Manual on Uniform Traffic Control Devices. The number and location of all signs and devices shall be as deemed necessary by the District Highway Director for the safe and efficient performance of the work and safety of the travelling public.

Care must be exercised so as not to disturb any existing State Highway Drainage or Traffic Duct/wiring Systems or any underground structures that exist. If said system is disturbed, it shall be restored immediately to its original condition. All expenses for restoring conditions shall be the responsibility of the Grantee(s).

6. Uniformed Police Officers or Certified Flaggers shall be provided and compensated by the Grantee(s) and shall be in attendance at all times until completion of the physical work.

"WORK WITHIN THE HARDENED SURFACE WITH CDF WAIVER APPROVED"

The pavement shall be saw-cut in neat, true lines along the length of the trench. The trench shall then be excavated, the utility installed, and backfilled. The backfill material shall consist of gravel or other suitable material conforming to MassDOT Specifications throughout, to a compacted depth of three inches below the existing surface.

The material shall be selected from excavation free from large lumps, clods or rock placed between the pipe and the walls of the trench in layers not exceeding 6" in depth and thoroughly compacted. Each layer, if dry, shall be moistened and then compacted by rolling or by tamping with mechanical rammers. Special care shall be taken to thoroughly compact the fill under the haunches of the pipe or conduit. This method of filling and compacting shall be continued until the material is level with the top of the pipe or conduit. The remainder of the filling shall consist of suitable material placed in successive layers not more than 6" in depth. The top layer shall be thoroughly compacted to within 3" of the existing surface.

The trench will then be patched temporarily with three (3) inches of Hot Mix Asphalt pavement Top Course placed in one layer to the finished grade of the roadway surface.

In the cases where the trench needs to include the repair of the entire travel lane/paved shoulder/curb-to-curb, the Grantee may patch the temporary trench with a minimum of seven (7) inches of Hot Mix Asphalt pavement or match existing thickness of this for the roadway, whichever is larger. Then after the 90 day settlement period, the Grantee will have to mill two (2) inches of the existing pavement and overlay the travel lane/paved shoulder/curb-to-curb with two (2) inches of Modified Top Course.

If required, steel plates may be utilized for the safety of overnight motorists. However, steel plates create a slippery surface and should only be used when necessary. The plates may need to be recessed to the finished grade of the roadway as directed by the Engineer. No plates may be left over the weekend. Therefore, the Grantee(s) shall schedule the work accordingly.

Temporary patches shall remain in place for 90 days before being replaced with permanent patch or until in the Engineer's judgment that final compaction and settlement of the trench area has taken place.

The Grantee(s) must then excavate the temporary patching and material to a depth of 7" below the existing surface and replace with the permanent patch which shall consist of 3" of Hot Mix Asphalt Base Course, 2" of Hot Mix Asphalt Binder Course, and 2" of Hot Mix Asphalt Modified Top Course.

All abutting edges of the existing pavement shall be coated with Bitumen for Tack Coat RS-1 Emulsion immediately prior to the placement of the permanent patch.

The infra-red method must be performed in conjunction with the permanent patch to create a smooth driving surface consistent with the existing roadway. The District Office must be notified two days prior to starting this work, so that an inspector may be assigned. This mix must be machine laid.

All traffic safety lines if disturbed shall be replaced in kind.

All trenches shall be maintained by the Grantee(s) from inception of this project at all times until the resurfacing of this particular portion of highway by MassDOT, Highway Division.

If it becomes necessary, MassDOT, Highway Division shall assign an inspector on any project and the inspector will be paid for under a reimbursable account by the Grantee(s).

The Grantee(s) shall be responsible for the maintenance and repair of this portion of the roadway and shall perform routine inspections for deficiencies such as settling, heaving, cracks, etc. This responsibility shall remain in effect until the resurfacing of this particular portion of highway is performed by MassDOT, Highway Division.

THE BACKFILLING METHOD FOR WORK WITHIN THE SHOULDER AREA WILL BE AS FOLLOWS:

Backfill for conduit or pipe shall be selected from excavation free from large lumps, clods or rock placed between the pipe and the walls of the trench in layers not exceeding 6" in depth and thoroughly compacted. Each layer, if dry, shall be moistened and then compacted by rolling or by tamping with mechanical rammers. Special care should be taken to thoroughly compact the fill under the haunches of the pipe or conduit. This method of filling and compacting shall be continued until the material is level with the top of the pipe or conduit. The remainder of the filling shall consist of suitable material placed in successive layers not more than 6" in depth. Each layer shall be thoroughly compacted as specified above.

Although the work is proposed to be performed within the soft shoulder, the excavation might be performed within the immediate area along the edge of road and may diminish the integrity of the hardened surface. Therefore, if the excavation directly abuts or tapers under the hardened surface of the roadway, the opening must be backfilled with Controlled Density Fill (CDF) to prevent undermining and preserve the roadway.

The Grantee(s) shall be responsible for the shoulder and roadway areas affected by the proposed work to be performed as described herein and shall routinely inspect said areas for deficiencies such as settling, heaving, cracks etc. This responsibility shall remain until work is performed at the subject location by MassDOT, Highway Division.

TIME RESTRICTIONS AND NOTIFICATIONS

Special attention shall be given when performing work that will impact MassDOT, Highway Division, snow and ice operations.

No work shall be performed in the hardened surface of the roadway between November 15th and April 1st of any year without prior written approval from the District Highway Director.

No pavement shall be laid between November 15th and April 1st of any year without prior written approval from the District Highway Director.

No work shall be performed on this project on Saturdays, Sundays, and Holidays, or on the Friday before a Holiday. Work is also restricted on the day before and the day after a long Holiday weekend without prior written approval by the District Highway Director.

No equipment, trucks, etc., shall occupy any part of the travelled way except between the hours of 9:00a.m. and 3:00p.m., Monday - Friday. In no case will operations exceed the specified hours. This includes the placement of traffic control devices, equipment or anything that restricts the flow of traffic through the construction zone. Any change in work hours will require prior written approval by the District Highway Director.

All other work on this project is restricted to a normal 8-hour day, Monday - Friday, with the prime Contractor and all subcontractors working on the same shift. Any change in work hours will require prior written approval by the District Highway Director.

GENERAL TRAFFIC MANAGEMENT AND SAFETY REQUIREMENTS

When any portion of the roadway will be blocked with equipment to facilitate the proposed work, the Grantee(s) will be required to adhere to the attached Traffic Management Plan (TMP) or submit a proposed TMP to MassDOT, Highway Division, to be reviewed and approved by the District Traffic Maintenance Engineer prior to working within or impacting the roadway. The plan must include information relating to proper signing, traffic control device placement and police details.

It is imperative to maintain two-way traffic at all times and these operations are managed so that motorists travel "delay" is minimized. At any time during the operation when a traffic delay of over twelve (12) minutes occurs and the situation is worsening, the Resident Engineer, Contractor or Police Detail will begin to suspend operations. Continuously increasing "delays" of over twelve (12) minutes are not to be permitted.

If traffic must be "stopped", the duration shall not be more than five (5) minutes.

Uniformed State/Local Police Officer(s) and their official vehicle(s), may be necessary to provide protection for those installing and removing all temporary traffic warning signs and devices and to perform all traffic management as required.

The Grantee(s) will monitor the flow of traffic during peak traffic volumes and if necessary, shall suspend all operations. Work will resume at the discretion of the Police detail officer and/or to the satisfaction of the supervising MassDOT, Highway Division, Engineer.

In the event of inclement weather or dense fog, which lessens the visibility of advanced warning signs, vehicles and workers, the Grantee(s) will suspend all operations so as not to interfere with the safety of the motoring public and the operations of work. In the event of snow or icing conditions, all vehicles and equipment must be removed from the roadway and/or shoulder area so as not to interfere with Snow and Ice Operations.

The Grantee(s) shall provide safe and ready means of access and egress to all public and private roads and drives 24 hours per day. Every effort must be made as not to interfere with or inconvenience all abutters throughout the duration of this project.

Signs and traffic control devices are required for advanced notice of the work and within the work area.

The Grantee(s) or Applicant will supply all required signs and traffic warning devices and shall be in accordance with the Massachusetts Manual on Uniform Traffic Control Devices. The number and location of all signs and devices shall be as deemed necessary by the Engineer for the safe and efficient performance of the work and the safety of the travelling public.

All warning devices shall be subject to removal, replacement and/or repositioning by the applicant as often as deemed necessary by the Engineer.

Cones or non-reflectorized warning devices shall not be left in operating position on the highway when the daytime operations have ceased. If it becomes necessary for MassDOT, Highway Division, to remove the construction warning devices or their appurtenances from the project due to negligence by the applicant, all costs for this work will be charged to the Grantee(s).

All vehicles, except passenger's cars, which are assigned to the permitted project and which operate on the site at speeds of 25 MPH or less, shall have an official SLOW MOVING VEHICLE emblem displayed. All vehicles and equipment on this project must be equipped with back-up alarms.

All personnel who are working on the travelled way or breakdown lanes shall wear approved safety vests and hard hats.

GENERAL CONDITIONS AND APPROVED PROCEDURES

The Grantee(s) must contact the "Dig Safe" Center at 811 to obtain a "Dig Safe" number prior to starting the proposed excavation for the purpose of identifying the location of underground utilities.

IF THE PROPOSED WORK FALLS WITHIN THE AREA OF A SIGNALIZED INTERSECTION, the Grantee(s) must contact the District Traffic Maintenance Engineer at (508) 884-4208 at least two business days prior to the commencement of said work to locate the existing traffic signal conduit/detectors and to coordinate this work so as not to disturb the traffic signals. The Grantee(s) will be responsible to repair/replace all damaged items and will be billed for any cost incurred to restore normal operation to MassDOT, Highway Division, signal equipment to the satisfaction of the Engineer.

Unless otherwise stated, no hardened surface of the State Highway may be disturbed.

When an opening in the roadway is required and permitted herein, the opening must be as small as possible to perform the proposed work.

If the integrity of any existing sidewalks, catch basins, manholes or any other underground structures or equipment is compromised, the Grantee(s) will reconstruct and/or replace all items according to MassDOT, Highway Division, Standards at the cost of the Grantee(s) and to the satisfaction of the Engineer.

The Grantee(s) must not disturb or remove any MassDOT, Highway Division, Bound(s) (MHB) associated with this project. If so disturbed or missing, the bound(s) must be reset/replaced by a Registered Land Surveyor. All procedures and materials must be in compliance with Massachusetts Design and Construction Standards. A copy of the paid bill must be submitted to this office upon completion of said work.

All traffic safety lines if disturbed shall be replaced in kind.

All disturbed areas within the State Highway Layout must be graded, loamed, and seeded to the Engineer's satisfaction.

All debris and litter remaining from the proposed construction shall be removed by the Grantee(s) and the area left clean daily.

DRAINAGE AND UTILITY CASTINGS

"The use of risers to adjust drainage and utility structures will not be allowed. All adjustment work done to existing or new drainage structures shall conform to Section 220 of MassDOT, Highway Division, Standard Specifications and according to Plates 201.3.0 and 202.9.0 of MassDOT, Highway Division, Construction Standards."

ENVIRONMENTAL LIABILITY AND COMPLIANCE

The Grantee(s) assumes all risk associated with any environmental condition within the subject property and shall be solely responsible for all costs associated with evaluating, assessing, and remediating, in accordance with all applicable laws, any environmental contamination (1) discovered during Grantee's work or activities under this Permit to the extent such evaluation, assessment or remediation is required for Grantee's work, or (2) resulting from the Grantee's work or activities under this Permit. The Grantee(s) shall notify MassDOT, Highway Division, of any such assessment and remediation activities.

The Grantee(s) is hereby held solely responsible for obtaining and maintaining any and all environmental compliance permits required by local, state, and federal laws and regulations when regular or emergency work is proposed within, or in close proximity to, any wetland area. These environmental compliance requirements include, but are not limited to, a Negative Determination of Applicability or Order of Conditions from the local Conservation Commission, a Water Quality Certificate from the Department of Environmental Protection, and a Programmatic General Permit from the U.S. Army Corps of Engineers. The Grantee(s) shall forward to MassDOT, Highway Division, a copy of each such environmental compliance permit.

CLOSING CONDITIONS

ALL OF SAID WORK SHALL COMPLY WITH THE TERMS AND CONDITIONS HEREIN, AND MUST BE DONE AS DIRECTED BY AND TO THE SATISFACTION OF THE ENGINEER.

All work done under this contract shall be in conformance with the Massachusetts Highway Department Standard Specifications for Highways and Bridges dated 1988 and the English Supplemental Specifications dated February 25, 2012 edition of the Massachusetts Department of Transportation, Highway Division "Supplemental Specifications to the 1988 English Standard Specifications for Highways and Bridges and the 1995 Metric Standard Specifications for Highways and Bridges". All construction shall conform to the March 2012 edition of the Massachusetts Department of Transportation, Highway Division "Construction Standard Details (English Edition)"; the 2009 Manual on Uniform Traffic Control Devices with Massachusetts Amendments; the 1990 Standard Drawings for Signs and Supports; the 1968 Standard Drawings for Traffic Signals and Highway Lighting; the latest edition of American Standard for Nursery Stock; the Plans and these Special Provisions.

The Grantee(s) shall indemnify and save harmless the Commonwealth and MassDOT, Highway Division, against all suits, claims or liability of every name and nature arising at the time out of or in consequence of the acts of the Grantee(s) in the performance of the work covered by this Permit and/or failure to comply with the terms and conditions of this Permit whether by themselves or their employees or subcontractors.

THE GRANTEE(S) SHALL CONTACT THE PERMITS SECTION AT (508) 884-4306 WHEN THE WORK REQUIRED UNDER THIS PERMIT HAS BEEN COMPLETED IN ORDER FOR A FINAL INSPECTION TO BE PERFORMED BY MASSDOT, HIGHWAY DIVISION.

A COPY OF THIS PERMIT MUST BE ON THE JOB SITE AT ALL TIMES FOR INSPECTION. FAILURE TO HAVE THIS PERMIT AVAILABLE AT THE SITE WILL RESULT IN SUSPENSION OF THE RIGHTS GRANTED BY THE PERMIT.

No work shall be done under this Permit until the Grantee has communicated with and received instructions from MassDOT, Highway Division's District Highway Director at 1000 County Street, Taunton, MA 02780.

The Permit shall be void unless the work herein contemplated shall have been completed before NOVEMBER 4, 2015.

Dated at Taunton this 4TH day of NOVEMBER, 2014.

MassDOT-Highway Division,

By

Mary-Joe Perry
District Highway Director

FSJ: fsj
cc: Foreman
Construction

massDOT
Massachusetts Department of Transportation
Highway Division

RECEIVED
SEP 15 2014
MASS DOT - DIST. 6

Application for Permit to Access State Highway

This Access Permit Application, including the attached Access Permit Submittal Checklist, must be completed in full by the Applicant. Instructions for this page are located on page 2. Descriptions of the two types of access permits and related categories are located on page 6. MassDOT will make the final determination regarding Access Permit Application type and category.

RECEIVED
SEP 16 2014
PERMITS OFFICE

1. Town/City: Town of Plymouth
2. State Highway route number and/or name: Samoset Street
3. Locus/Property Address: Approximately from the Myles Standish Plaza to 128 Samoset Street
4. Description of property and/or facility for which access is sought (attach additional sheets if necessary):
   Westbound lane of Samoset Street west of Route 3 and 44
5. Description of work to be performed within State Highway Layout (attach additional sheets if necessary):
   Installation of 8-inch gravity sewer and manholes. See attached design plan.

☐ Telecommunications (wireless or wireline) or Renewable Energy (Solar, Wind, etc) – Agreement Process and OREAD* coordination required. (*see pg 2 Instruction)

6. Dig Safe number: TBD
7. Applicant Information [1] (See footnote below.)
   Name: Jonathan Beder - DPW Director
   Mailing Address: 159 Camelot Drive, Plymouth, MA 02360
   Telephone: 508-830-4162 (x105)
   Fax: 508-830-4165
   E-Mail: JBeder@townhall.plymouth.ma.us
   Signature: [signature]
   Print Name: Jonathan Beder
   Date: Sept 9, 2014
8. Property Owner
   Name:
   Mailing address:
   Telephone:
   Fax:
   E-Mail:
   Signature:
   Print Name:
   Date:

Return completed application, including Submittal Checklist, to the District Highway Director for your town/city. Refer to reverse side for appropriate address.

For office use only. Do not write below this line.

1. Application number: 5-2014-0473
2. Date received: SEP 16 2014
3. Fee amount (non-refundable):
4. Completeness Pre-Review date:
5. MEPA required (yes or no):
   ENF-EOEEA Cert. #
   EIR-EOEEA Cert. #
   Other-EOEEA Cert. #
6. Section 61 Finding date:
7. Mass. Historic Action (yes or no):
8. Plans returned to DHD:
9. Permit Type/Category:
10. Application complete date:
11. Permit written date:
12. Permit issued date: NOV - 4 2014
13. Permit denied:
14. Permit Recording date at Registry of Deeds

[1] If an agent is representing an Applicant, the application must include a notarized letter from the Applicant outlining the specified duties and responsibilities of the agent. Where work is proposed on a utility, the utility department must sign the application as the Applicant(s).

UTILITY COORDINATION AND REQUIREMENTS

One NSTAR Way, Westwood, Massachusetts 02090

January 29, 2015

John F. Finnegan, Jr., P.E.
Project Engineer–AECOM-Water

Re: Conditions to cross NSTAR gas lines

Dear Mr. Finnegan:

NSTAR Gas has been informed that the Town of Plymouth (Contract No. 2014-PH1, Samoset St Sewer System Expansion) intends to install a 8" DI Forcemain within the existing NSTAR Electrical and High Pressure Gas Main utility easement. Please include the following NSTAR requirements as a reference with the construction bid documents for this project. An approval letter should be obtained by the specific contractor once the project is awarded.

NSTAR Gas requires the following general conditions when working within the easement;

- Minimum 2'-0" Horizontal separation between all utilities and NSTAR's gas main
- Minimum 1'-0" Vertical separation between the bottom of the utility trench and the top of NSTAR's main.
- Minimum 1'-0" Vertical separation between the top of the utility / concrete and the bottom of NSTAR's main.
- In the event that the utility is run below our main, notify NSTAR prior to any work. All crossings must be as close to 90 degrees as possible.
- Surface markers must be installed at all utility crossings. NSTAR must clearly know where your utilities cross in case excavation of our pipeline is necessary.
- No structures are allowed within the easement
- All soil erosion must be stabilized immediately
- Exposed or undermined gas mains must be properly supported and protected from the hazards of construction
- During excavation, use an observer, spotter or monitor when performing machine excavation, and don't dig any closer than state regulations dictate. After you've reached state mandated off-set, the remaining excavation must be hand dug or removed by non-invasive methods.
- Any damage to a plastic or steel gas main or the protective coating on a steel gas main must be reported immediately to NSTAR Gas Company, Craig Mello at (508) 441-5817. or Ralph Gurney at (339) 987–7669.
- All exposed or undermined gas mains must be properly backfilled to prevent future settling of the pipe. Backfill material shall be clean earth or sand thoroughly compacted in 6-inch lifts.
- Heavy equipment crossings can compromise our pipeline's safety. Depending on the equipment size and types of tracks or wheels, the weight load on the surface can place extra stress on the pipeline. NSTAR may require additional padding or steel plates over the pipeline depending on soil stability and rock composition.
- Survey and install stakes along the border of the gas easement to clearly identify the gas easement for construction personnel. Fencing along the easement border that is closest to construction is also recommended to ensure no mechanical excavators are sited or moved above the pipeline while work is carried out parallel to the easement.
- If any blasting is determined to be necessary then NSTAR must receive a blasting plan for review and approval since blasting can profoundly impact our facilities. Please allow two weeks for review and approval of any proposed blasting plan. NSTAR can require the contractor to provide a blasting inspector with seismograph equipment to confirm the blasting plan is being followed.
- Pile driving or vibrator activity must be approved by NSTAR.
- Notify NSTAR prior to any work on our easement and always contact Dig Safe before excavating.

If you have further questions or concerns please feel free to reach me at 781-441-8140.

Sincerely,

John M. Leskow

John Leskow
Project Engineer

CC: Craig Mello, NSTAR

1.0 PURPOSE

This guideline presents the requirements for construction activities in the vicinity of Spectra Energy's pipeline(s) or pipeline right-of-way and the movement of vehicles or mobile equipment within or across the right-of-way by parties other than Spectra Energy (herein referred to as the Company). These requirements are general in nature whereby specific circumstances may necessitate special considerations.

The following areas are addressed.

1.0 Purpose
2.0 Pre-Construction Approvals and Notifications
3.0 Site Visits To Locate Facilities
4.0 Items to be Provided for Review Process
5.0 General Requirements
6.0 Excavation
7.0 Blasting
8.0 Facility Crossings

If any of the conditions stated in this document can not be satisfied, the Company representative shall be advised immediately.

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2.0 PRE-CONSTRUCTION APPROVALS AND NOTIFICATIONS

2.1 Activities Requiring Company Approval

Prior to commencing work, the encroaching party shall obtain the Company's permission for any proposed excavation, construction or temporary crossing upon, along, over, under or across the Company's pipeline(s) or pipeline right-of-way as described below.

- Crossings with anything larger than a standard passenger vehicle or mobile equipment outside the traveled portion of a highway or public road.

- Construction of a facility such as:
  - New permanent buried facilities – water, gas, oil, sewer, electrical, fiber optic, drains, etc.
  - New permanent aboveground facilities – power, telecommunication, cable tv, etc.
  - New road or railroad installations or improvements
  - New developments, grade changes, structures, parking areas, ditches, etc.
  - Minor excavation activities – fences, trees, facility maintenance, etc.

- Excavation using explosives or power-operated (mechanical) equipment within the Company's pipeline right-of-way.

- Blasting activities (including seismic survey activities) in the vicinity of the Company's pipeline right-of-way (see Section 7.0)

If the encroaching party is considering an activity which is not

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listed above, they should contact the Company representative to determine if their activity requires permission and subsequent approval.

2.2 Request for Encroachment

The encroaching party shall contact the Company to discuss details of the proposed construction or crossing activity and the information required for the Company's review.

Copies of any proposed plans and/or drawings may be required for certain construction or encroachment activities within or directly affecting the Company's pipeline right-of-way and shall be submitted to the Company for review and approval at least 30 days prior to the commencement of work.

2.3 Company Response to Encroachment Requests

The Company shall be given at least three (3) working days advance notice prior to the actual commencement of any construction, excavation or crossing activities over or near its pipeline right-of-way so that the Company may locate its pipeline(s) and have a field representative present during these activities.

Additional time for technical analysis may be needed for certain construction projects affecting the integrity of the Company's pipeline(s).

The Company representative will make a determination of the complexity of the proposed activity and the level of Company approval required.

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3.0 SITE VISITS TO LOCATE FACILITIES

3.1 The Company considers it essential that landowners, builders, utility companies, developers and contractors know the location and depth of the Company's pipeline(s) and requires that the pipeline(s) be shown on any plans or drawings to be submitted for review.

3.2 If requested, the Company will field locate and mark its pipeline(s) at selected points in accordance with federal, state and/or local requirements at no cost to the encroaching party. However, if the Company representative requires the pipeline be located by excavation, the cost to excavate the pipeline and restore surface improvements (e.g., pavement, landscaping, and sidewalks) shall be the responsibility of the encroaching party. Note: A Company representative must be present during any excavation to expose the pipeline. During this period, accurate survey data of the Company's pipeline(s) may be requested by the Company. This data shall be obtained by a qualified surveyor provided by the encroaching party for the preparation of plan, section and profile drawings.

3.3 In addition to complying with the above requirements, the encroaching party shall comply with the provisions of all federal, state and/or local one-call regulations relating to excavation and demolition work in the vicinity of underground facilities.

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4.0 ITEMS TO BE PROVIDED FOR REVIEW PROCESS

Simple residential driveways or utility crossings of the Company's pipeline right-of-way may not be subject to all of the requirements of this section. The Company will determine what information is required to be submitted for review on a case by case basis.

At a minimum the following information shall be provided with a request to the Company to determine if equipment/vehicle crossings and associated construction activity can be approved.

- a drawing or sketch showing the pipeline in relation to the proposed construction activity
- excavation plan including the method of installation of all facility crossings
- equipment description with weights and track/tire dimensions of any equipment/vehicles that may cross the Company's pipeline(s) during construction activity

In addition, any construction activity that requires the submission of drawings to a permitting agency for construction adjacent to or encroaching on the Company's pipeline(s) or pipeline right-of-way must include the information regarding Company facilities and pipeline right-of-way specified in this section.

4.1 Upon review of this specification and the incorporation of all applicable requirements, a complete set of design drawings showing existing conditions and proposed alterations shall be submitted to the Company for review.

4.2 Upon final approval from the Company, two (2) sets of the final (definitive) design drawings and an electronic copy shall be provided to the Company.

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4.3 The Company's pipeline(s) and pipeline right-of-way limits shall be accurately shown on all drawings. Upon 72 hours advance notice, Company personnel will locate and mark the location of the Company's pipeline(s). The encroaching party's survey crew can then accurately locate the facility by a field survey.

4.4 The encroaching party's survey crew will be responsible for laying out the proposed facility in the field and locating the Company's facility horizontally and vertically, accurately representing it in the plan and profile views on the drawing(s). The Company's Region Technical Staff will evaluate field data to determine whether additional design requirements are necessary for areas of proposed equipment/vehicular travel.

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5.0 GENERAL REQUIREMENTS

5.1 No buildings, structures or other obstructions may be erected within, above or below the Company's pipeline right-of-way. If requested, the Company will furnish pipeline easement information which describes the pipeline right-of-way width.

5.2 Wire type, stockade, decorative and similar type fencing that can be easily removed and replaced may cross the Company's pipeline right-of-way at or near right angles. Fences crossing the Company's pipeline right-of-way must have a minimum 10 foot wide gate for access. No fence shall be allowed within the Company's pipeline right-of-way parallel to the Company's pipeline(s).

5.3 Planting of trees is not permitted on the Company's pipeline right-of-way. The Company may side trim trees that overhang across the Company's pipeline right-of-way to eliminate obstruction of right-of-way visibility from the ground or air.

5.4 Planting of shrubs, bushes or other plants associated with landscaping on the Company's pipeline right-of-way is subject to Company approval and shall not exceed 5 feet in height at maturity. Shrubs, bushes or other plants shall not be installed within 10 feet of the Company's pipeline(s). The Company will not be responsible for the cost of replacing any landscaping damaged, destroyed or disturbed due to maintenance activities on the Company's pipeline right-of-way.

5.5 No drainage swales and no reductions in grade are permitted on the Company's pipeline right-of-way.

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Limited additional fill may be deposited with prior written approval from the Company.

Proposed landscaping grades shall provide for 3 foot minimum cover over the Company's pipeline(s). The Company shall determine the maximum cover allowed over a Company pipeline(s) based on pipeline specifications and local conditions, including such issues as soil types. Proposed landscaping grades shall not exceed the Company's maximum allowable slope of 4:1 longitudinal with the pipeline and/or 8:1 cross-slope.

The Company reserves the right to modify these cover/grade requirements if deemed necessary. Proposed grades shall not restrict Company access to its right-of-way or cause ponding of surface water on the Company's pipeline right-of-way. Proposed grades shall not redirect the flow of water on to the Company's pipeline right-of-way or generate any amount of erosion on or near the Company's pipeline right-of-way.

5.6 A Company representative shall give prior approval for equipment/vehicles to cross the Company's pipeline(s) at any location.

Maximum and minimum depths of cover for all areas of equipment/vehicular travel (e.g., highways, roads, railroads, construction access, driveways, parking lots, etc.) will be determined by the Company and federal, state and/or local requirements. For this purpose, cover can be defined as the distance from the top of the pipeline to the finished grade. Mitigative methods where the cover is insufficient will be determined on a case by

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case basis.

Additional cover, construction mats, or temporary structural spans shall be installed for the protection of the Company's pipeline(s) at the point where equipment/vehicles will be crossing unless approval to cross without protection is specifically granted by the Company. Installation and maintenance of the crossing shall be the responsibility of the encroaching party. The Company will provide specifications for the crossing of pipeline facilities.

5.7 Test pits are used to supply the encroaching party with accurate elevations of the Company's pipeline(s) and to determine the quality of the fill material around the pipeline(s). At the discretion of the Company, test pits may be required in areas where equipment/vehicle crossings and/or facility crossings are proposed. For additional information on test pits reference Sections 6.2 and 6.3.

5.8 Parking areas should be planned so as to avoid covering the Company's pipeline right-of-way if possible.

5.9 No roads, pipelines, cables or utilities may be installed parallel to the Company's pipeline(s) within the Company's pipeline right-of-way.

5.10 All pipelines, roads, electrical cables and other utilities shall cross the Company's pipeline right-of-way at an angle at or near right angles, if practical.

5.11 If, in the judgment of the Company, the proposed facility necessitates the installation of casing pipe and/or other

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alterations to protect the Company's pipeline(s), the encroaching party will be required to execute a reimbursement agreement. The encroaching party will be required to pay the Company all or a percentage of the estimated cost of these alterations prior to the Company beginning any construction activity. Once the actual costs have been incurred and tabulated by the Company, cost variances shall be settled.

5.12 At the discretion of the Company, concrete slabs or other protective devices may be installed over the Company's pipeline(s) to provide protection. Design and installation drawings for the concrete slab/device will be provided to the encroaching party upon request.

5.13 All design standards mandated by federal, state and/or local government agencies shall be satisfied and a letter stating such shall be submitted to the Company prior to receiving final approval of the encroaching party's project.

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6.0 EXCAVATION

Excavation operations shall be performed in accordance with the guidelines set forth below.

6.1 **No excavation, crossing, backfilling or construction operations near the Company's pipeline(s) or pipeline right-of-way shall be performed unless the Company representative is on site. The Company representative shall have full authority to stop the work if it is determined that the work is being performed in an unsafe manner or if a foreign object is spotted.**

6.2 During the period of April 15 - November 1 test pits may be performed by the encroaching party provided Company personnel are present. Test pits can be scheduled by contacting the applicable Company representative. The Company will make every effort to accommodate the encroaching party's schedule for excavation of test pits. Such scheduling however, is subject to availability of Company personnel, weather, field operating conditions, etc.

6.3 During the period of November 1 - April 15 test pit excavation of the pipeline by means of mechanical equipment is not allowed. In instances where the encroaching party must expedite the design process, pipeline elevations may be obtained, depending on field conditions, by hand digging or soft digging equipment. The encroaching party must contact the applicable Company representative to coordinate these activities.

6.4 Excavation shall not be permitted within the Company's

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pipeline right-of-way until an excavation plan has been reviewed and approved by the Company representative. The excavation plan may be a written document or a verbal discussion with the Company representative. At a minimum, the excavation plan shall include but not be limited to the following:

- Backhoe set-up position in relationship to the pipeline
- Need for benching to level backhoe
- Required excavation depth and length
- Sloping and shoring requirements
- Ingress/egress ramp locations
- Minimum clearance requirements for mechanical equipment
- Pipeline location and depth
- Verify bar has been welded onto backhoe bucket teeth and side cutters have been removed
- Spoil pile location
- Compliance with applicable OSHA regulations

6.5 The use of mechanical equipment in the vicinity of the Company's pipeline(s) shall be directed by the Company representative in accordance with Company procedures and applicable one-call regulations. The tolerance zone for excavations using mechanical equipment is 18 inches (unless otherwise required by state law) until the pipeline is visually located. Hand tools or soft dig equipment shall be used to complete the final excavation of the pipeline inside the "restricted" mechanical equipment limits of the excavation.

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6.6 The use of a trenchless excavation method (i.e., bored crossings) shall be employed in such a way as to ensure a minimum radial clearance required by applicable standards is obtained between the new facility and the Company's pipeline(s).

6.7 Federal regulations require that the Company's pipeline(s) be inspected whenever it is exposed. Applicable OSHA regulations pertaining to excavations must therefore be met to ensure the safety of the Company representative who must enter the excavation. Furthermore ample time should be provided to allow the Company to perform relevant inspections prior to proceeding with backfill operations.

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7.0 BLASTING

Blasting operations shall be performed in accordance with the minimum guidelines set forth below.

7.1 The Company shall be advised of any blasting proposed within 200 feet of the Company's pipeline(s) and 500 feet for large scale quarry-type blasting. No blasting is permitted within the Company's pipeline right-of-way, and no blasting shall occur outside the Company's pipeline right-of-way if the Company determines that such blasting may be detrimental to its facilities.

7.2 The Company reserves the right to require that the party responsible for blasting furnish a detailed blasting plan at least three (3) working days prior to blasting to allow for evaluation and to make arrangements for a Company representative to witness the blasting operation, including drilling and loading holes. Applicable blasting codes shall be followed in all cases.

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8.0 FACILITY CROSSINGS

All buried facilities shall be installed as noted below and as stated in Sections 5.9 and 5.10, as appropriate.

8.1 Buried facilities shall be installed below the Company's pipeline(s). The Company requires a minimum of 12 inches of clearance however in some situations this may need to be increased (e.g., bored crossings). Additional separation may be required in marshy areas or other areas where insufficient clearance would have a potential to cause future problems.

8.2 If the normal crossing requirements present undue difficulties as determined by the Company, buried facilities may be installed above the Company's pipeline(s) with prior approval from the Company representative. All such facilities shall be installed with a minimum of 12 inches of clearance. The Company will not be responsible for any damage or required repairs which are caused by the Company's operating and maintenance activities when facilities are installed above the pipeline(s). Protective measures such as a concrete encasement, ditch marking tape, and/ or above ground markers may be required as deemed necessary by the Company representative.

8.3 Suitable backfill shall be placed between the facility and the Company's pipeline(s). Suitable backfill is backfill free of rocks, refuse and any foreign material including, but not limited to, skids, welding rods, pipe rings, trash, tree and shrubbery limbs. In the case of anticipated crossing by equipment/vehicles the encroaching party shall provide specific material and

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compaction specifications (AASHO or equivalent) for review by the Company.

8.4 The installation of test leads (two No. 10 THWN black insulated copper wires) attached at the point of crossing for corrosion control monitoring may be required for metallic lines as directed by the Company representative. Test wires shall be routed underground and terminated at a point specified by the Company.

8.5 The following requirements shall be met for fiber optic cables which encroach upon the Company's pipeline right-of-way.

8.5.1 High capacity fiber optic cable shall be installed in a rigid non-metallic conduit or covered in 6-8 inches of concrete which has been colored with an orange dye extending across the entire pipeline right-of-way. Other protective measures may be considered for non-high capacity cables.

8.5.2 The fiber optic cable shall be installed a minimum of 12 inches below the Company's pipeline(s) across the entire width of the pipeline right-of-way, unless approved by the Company representative.

8.5.3 Orange warning tape shall be buried a minimum of 18 inches directly above the fiber optic cable across the entire width of the Company's pipeline right-of-way, where practical.

8.5.4 The fiber optic cable crossing shall be clearly and permanently marked with identification signs on both

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sides of the Company's pipeline right-of-way. Markings shall be maintained by the encroaching party for the lifetime of the facility.

8.6 The information listed below shall be furnished to the Company for all proposed electrical cables which will encroach upon the Company's pipeline right-of-way.

- Number, spacing and voltage of cables
- Line loading and phase relationship of cables
- Grounding system
- Position of cables and load facilities relative to pipeline(s)

8.7 Specific installation requirements for cables carrying less than 600 volts shall be determined by the Company on a case by case basis.

8.8 The following installation requirements shall be met for buried electrical cables carrying over 600 volts but less than 7,600 volts. The Company's Region Technical Staff will determine the installation procedures for buried electrical lines carrying voltages over 7,600 volts on a case by case basis.

8.8.1 The electrical cable shall be installed in a rigid non-metallic conduit covered in a minimum thickness of 2 inches of concrete which has been colored with a red dye extending across the entire width of the Company's pipeline right-of-way.

8.8.2 The electrical cable shall be installed a minimum of

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12 inches below the Company's pipeline(s) across the entire width of the Company's pipeline right-of-way, unless approved by the Company representative.

8.8.3 Each phase conductor should be surrounded with a spirally wound, concentric neutral conductor. The neutral may be within the outer cable jacket.

8.8.4 Red warning tape shall be buried a minimum of 18 inches directly above the electric cable across the entire width of the Company's pipeline right-of-way, where practical.

8.8.5 The electric cable crossing shall be clearly and permanently marked with identification signs on both sides of the Company's pipeline right-of-way.

8.9 Overhead power line, telephone line and telecommunication installations shall be reviewed by the Company on an individual basis.

8.9.1 Overhead lines shall be installed with a minimum clearance of 25 feet above the grade of the Company's pipeline right-of-way. The installation of poles and guys will not be permitted on the Company's pipeline right-of-way, and not within 25 feet from a Company appurtenance, unless assurances are made that the encroachment will not affect the Company appurtenance as a result of a fault or failure.

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DOCUMENT 00905

CHANGE ORDER FORM

SRF Number N/A
Public Entity _____
Contract Number _____
Change Order Number _____

Contract Amount (As Bid): $ _____

Net Change in Contract Price (this change order): $ _____

Total Adjusted Contract Price (including this and all other change orders): $ _____

This change order extends the time to complete the work by: _____ calendar days.

The extended completion date is _____

This change order checked by: _____ _____
(Chief) Resident Engineer Date

This change order is requested by: _____

This change order is recommended by: _____

_____ _____ _____
Consultant Engineer P.E. Number Date

The undersigned agree to the terms of the change order.

_____ _____
Contractor Date

_____ _____
Owner Date

Certification of Appropriation under M.G.L. c.44, §31C: Adequate funding in an amount sufficient to cover the total cost of this change order is available.

By: _____ _____
Certification Officer (Auditor, accountant, treasurer) Date

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

DEP/DMS

Policy Memorandum No. CG-10

Attachment 1 Page A-2

CHANGE ORDER FORM (Continued)

Public Entity _____

SRF No: N/A Contract No. _____ Change Order No. _____

Contract Title: _____

Owner's Name: _____

Owner's Address: _____

Contractor's Name: _____

Contractor's Address: _____

Description of Change

_____

_____

_____

_____

_____

Reason for Change

_____

_____

_____

_____

_____

_____

_____

_____

Policy Memorandum No. CG-10
Attachment 2 - Page B-1

CALCULATION SHEET

(1)	Labor			
	Foreman	10 hrs @ $10.00/hr.	$100.00	
	Engineer	10 hrs @ 8.50/hr	85.00	
	Operator	10 hrs @ 9.50/hr	95.00	
	Laborers	24 hrs @ 7.00/hr	168.00	
				$448.00
(2)	Direct Labor Cost (use the agreed upon Direct Labor Cost)			
	30% *of $448			$134.00
	* (Used for example purposes only)			
(3)	Materials & Freight			
	150 l.f. of 12” pipe @ $2.00/l.f.		$ 300.00	
	15 v.f. precaset SMH		1,700.00	
	Freight (Slip # 2510 Attached)		25.00	
				$2,025.00
(4)	Equipment			
	1 Backhoe	10 hrs @ $80.00/hr	$ 800.00	
	1 Truck-crane	10 hrs @ $100.00/hr	1,000.00	
				$1,800.00
			Total (Items 1 through 4)	$4,407.00
(5)	15% markup for Overhead, Profit			
	15% of $4,407			$661.00
(6)	5% markup for general contractor (if subcontractor is involved)			
	5% of $4,407			$220.00
(7)	Credits (deductibles)			($323.00)
			Total Cost	$4,965.00

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

END OF DOCUMENT

DOCUMENT 00945

CERTIFICATE OF SUBSTANTIAL COMPLETION

OWNER's Project No. _____ ENGINEER's Project No. _____

Project: _____

CONTRACTOR _____

Contract For _____ Contract Date _____

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

To: _____

And To: _____

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on

_____

DATE OF SUBSTANTIAL COMPLETION

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of Contractor to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by Contractor within _____ days of the above date of Substantial Completion.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as follows:

OWNER: _____

_____

CONTRACTOR: _____

_____

The following documents are attached to and made a part of this Certificate:

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Executed by ENGINEER on _____, 20_____.

_____

ENGINEER

By _____

CONTRACTOR accepts this Certificate of Substantial Completion on _____, 20_____.

_____

CONTRACTOR

By _____

OWNER accepts this Certificate of Substantial Completion on _____, 20_____.

_____

OWNER

By _____

END OF DOCUMENT

DOCUMENT 00950

WAIVER OF LIENS

Contract No.: _____ Agreement Date: _____

Owner: _____

Project Name: _____

Completion Date per Agreement and Change Orders: _____

The undersigned Contractor hereby swears under penalty of perjury that (1) all previous progress payments received from the Owner on account of Work performed under the Contract referred to above have been applied by the undersigned to discharge, in full, all obligations of the undersigned incurred in connection with Work covered by prior Estimates for Partial Payment under said Contract, being Estimates Number 1 through _____ inclusive; and (2) all labor, materials and equipment incorporated in said Project or otherwise listed in or covered by these Estimates for Partial Payment are free and clear of all liens claims, security interests and encumbrances, except those listed below by obligee, nature and amount of obligation and covered by appropriate Bond or Bonds, as listed beside each obligation and attached to and made a part of this certification.

Obligation	Bond

_____ _____

Date Contractor

_____

Signed by Officer of Corporation

_____

Title

COUNTY OF _____

STATE OF _____

Before me on this _____ day of _____, 20_____personally appeared _____

_____ known to me, who being duly sworn, did depose and save that he/she is the _____ (Officer) of the Contractor above mentioned; that he/she executed the above statement on behalf of said Contractor and that all of the statements contained therein are true, correct and complete.

_____

NOTARY PUBLIC

_____

My Commission Expires

END OF DOCUMENT

DOCUMENT 00960

CERTIFICATE OF FINAL PAYMENT AND COMPLETION OF WORK

Contract No.: _____ Agreement Date: _____

Owner: _____

Project Name: _____

Completion Date per Agreement and Change Orders: _____

FINAL CERTIFICATION OF CONTRACTOR

_____

_____

_____

agrees to accept $ _____ as full and final payment for all work completed under this Contract dated _____ with the _____
_____.

I certify that all construction has been carried out in substantial compliance with the Contract Documents, and that all labor, equipment, materials and Subcontractors have been or will be paid in accordance with the requirements of the General Laws of the Commonwealth of Massachusetts.

_____ _____

Date Contractor

_____

Signed by Officer of Corporation

_____

Title

END OF DOCUMENT

DOCUMENT 00965

TRANSFER OF TITLE

_____, (CONTRACTOR), a corporation, or a partnership, or an individual, having a principal place of business in _____ hereby transfers and conveys to _____ OWNER), title to the following material(s) delivered and stored at the designated storage area(s) at _____ upon the receipt of $ _____, which amount is to be included in the Application and Certification for Payment No. _____.

Therefore, upon the receipt of the sum of $ _____* paid by the OWNER, the CONTRACTOR waives all of its statutory lien rights regarding the following material. The storage, transportation, protection and ultimate installation of this material remain the responsibilities of the CONTRACTOR.

In witness whereof, the CONTRACTOR has caused this instrument to be executed this _____ day of _____ 20_____ by its duly authorized representative.

_____ _____
Name Title

_____
Signature

* Amount subject to reduction by applying applicable retainage percentage according to the terms of the Contract between the OWNER and CONTRACTOR.

Title to the following material is being transferred by this document:

County of _____

_____ then personally appeared and acknowledged the foregoing instrument to be the free act and deed of _____ before me.

Sworn to me this _____ day of _____ 200___.

_____
NOTARY PUBLIC

My Commission Expires: _____

END OF DOCUMENT

SECTION 01020

ALLOWANCES

PART 1 GENERAL

1.01 SUMMARY

A. Include all costs related to the scheduled allowances in the applicable bid item of DOCUMENT 00300, FORM FOR GENERAL BID. Allowance amounts listed herein have been estimated. Actual paid invoice amounts shall be used for reimbursement purposes.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. Include in the Contract Price, scheduled allowances included under the applicable Bid Item of BID FORM specified in the respective specification sections and listed below:

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS – Not Used

1.05 PRODUCT HANDLING – Not Used

1.06 ALLOWANCES FOR PRODUCTS

A. The amount of each allowance includes:

1. The cost for utility companies’ labor and materials for the utility companies to provide utility service to the pump station.

2. The cost for Contractor to furnish plant materials at the Pump Station and Temporary Storage Yard.

B. In addition to the amount of each allowance, include, except as specified herein, in Bid Item 21 the Contractor's costs for:

1. Coordination with the Utility Companies.

2. Materials handling at the site, including unloading, uncrating, and storage.

3. Protection of the materials from the elements and from damage.

4. Labor for installation and finishing, except where labor is specified to be a part of the Allowance.

5. Other expenses required to complete the installation.

6. Contractor's and Subcontractor's overhead and profit.

C. The scheduled allowances are as follows:

Bid Item Number	Description	Amount
21B	Plant Materials at Pump Station and Temporary Storage Yard	$15,000
21C	Electric Company Connection/Service Fee	$25,000
21D	Telephone Company Connection/Service Fee	$7,500
21E	Gas Company Connection/Service Fee	$20,000

1.07 SELECTION OF PRODUCTS UNDER ALLOWANCES

A. Engineer's duties are as follows:

1. Make selection in consultation with the Owner and obtain Owner's written decision, designating:

a. Product, model and finish.

b. Accessories and attachments.

c. Cost to the Contractor, delivered to the Project Site or installed, as applicable.

2. Transmit Owner's decision to the Contractor.

3. Prepare Change Orders.

B. Contractor's duties are as follows:

1. Obtain proposals from suppliers and installers when requested by the Engineer.

2. Make appropriate recommendations for consideration by the Engineer.

3. Notify the Engineer promptly of:

a. Any reasonable objections the Contractor may have against any supplier, or party under consideration for installation.

b. Any effect on the construction schedule anticipated by selections under consideration.

1.08 ADJUSTMENT OF COSTS

A. Should the net cost be more or less than the specified amount of the allowance, the Contract Price shall be adjusted accordingly by Change Order.

1. The amount of the Change Order will recognize any changes in handling costs at the Project Site, labor, installation costs, overhead, profit and other expenses caused by the selection under the allowance.

2. The amount of the Change Order for the Electric Company Connection/Service Fee, Telephone Company Connection/Service Fee, and Gas Company Connection/Service Fee shall not recognize any changes in handling costs at the Project Site, labor, installation costs, overhead, profit and other expenses caused by the selection under the allowance.

B. Submit any claims for anticipated additional costs at the Project Site, or other expenses caused by the selection under the allowance, prior to execution of the Work.

C. Submit documentation or actual additional costs at the Project Site, or other expenses caused by the selection under the allowance, within 60 days after completion of execution of the Work.

D. Failure to submit claims within the designated time will constitute a waiver of claims for additional costs.

E. At Contract closeout, reflect all approved changes in Contract Price in the final statement of accounting.

PART 2 PRODUCTS - Not Used.

PART 3 EXECUTION - Not Used.

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE

A. The purpose of this section is to define the basis of measurement and payment for each of the unit price or lump sum items listed in BID FORM. If no quantity or bid item appears in BID FORM for any of the following described items, no Work of that description is anticipated on the project.

B. The Contractor shall become acquainted with all Work associated with each Payment Item and shall have no claim for additional compensation due to unfamiliarity with the Work required to complete each Item in accordance with the Contract Documents.

C. No payment will be made for any item of Work until all documentation required by the Contract Documents has been reviewed and approved by the Engineer.

D. No payment will be made for additional materials that are not installed on the Project.

E. The Owner reserves the right to withhold the fair market value for work not completed. In addition to the retainage on work completed as described in DOCUMENT 00855, SPECIAL CONDITIONS, COMMONWEALTH OF MASSACHUSETTS. Unbalanced bid items will specifically be subject to review and to this potential withholding from periodic payment applications.

1.02 PAYMENT ITEMS

Basis of Award

Item	Description
1.	Mobilization/Demobilization
2.	Sewer Pipelines and Associated Fittings
3.	Precast Concrete Manholes and Structures
4.	Manhole Frames and Covers
5.	Manhole Drop Connections – Not Used
6.	Chimneys
7.	Miscellaneous Cement Concrete
8.	Rock and/or Boulder Excavation
9.	Replacement of Unsuitable Material

10. Experimental Excavation

11. Fill for Embankments – Not Used

12. Sheeting and/or Shoring Ordered Left in Place – Not Used

13. Soil Compaction Tests

14. Road Base Course Material

15. Pavement Restoration

16. Remove and Relay or Replace Existing Utilities

17. Uniformed Traffic Police Officers

18. Engineer's Field Office

19. Environmental Protection

20. Dewatering

21. Samoset Street Sewer System Expansion Pump Station

1.03 BASIS OF MEASUREMENT AND PAYMENT

ITEM 1. MOBILIZATION/DEMOBILIZATION

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include transporting, mobilization, demobilization, utility connection fees, permits, licenses, bonds, insurance and all other incidental Work relative thereto.

B. Measurement. Measurement for mobilization/demobilization shall be made based on the lump sum amount bid as approved by the Engineer.

C. Payment. Payment for mobilization/demobilization listed in BID FORM shall be made at the lump sum price bid under this Bid Item. The amount of this lump sum shall not exceed five (5) percent of the Contract amount, excluding Item 1, and no payment shall be made in excess of this amount. An amount of seventy-five (75) percent of the amount bid under Item 1 (exclusive of normal Contract retainage) will be made when the Contractor has mobilized to the Project site(s) and is ready to start construction. The remaining twenty-five (25) percent (exclusive of normal Contract retainage) will be made following demobilization from the Project site(s).

ITEM 2. SEWER PIPELINES AND ASSOCIATED FITTINGS

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include: handling and dispersal of materials; clearing and grubbing; saw cutting of existing bituminous and cement concrete or reinforced cement concrete pavement; excavation (excluding that which is specified to be paid for under a separate Bid Item); backfill

above trench grade including all bedding materials (excluding material used to replace unsuitable material, controlled density fill and road base course material); removal and legal disposal of all existing utility lines not being relaid (including pipes, services, manholes and appurtenances); removal and legal disposal of existing utility materials (as required); compacting trenches (excluding soil compaction tests specified to be paid for separately); sheeting and shoring not ordered left in place; loaming and seeding; landscaping; curbing replacement; removing and resetting property markers, signs and mail boxes; connections to existing pipeline(s) and services; dust control including mechanical sweeping; all permanent and temporary fittings, caps, plugs, restraints and the like; two-way sewer lateral cleanout; flushing and testing; dewatering of trenches; polyethylene encasement; daily cleanup; restoration of all areas disturbed by the Contractor's operations; all Work as specified in DIVISION 1 – GENERAL REQUIREMENTS (excluding Environmental Protection specified to be paid for under a separate Bid Item); and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing pipelines and associated fittings shall be as follows:

1. The length of pipe and fittings (pipeline), to be paid for shall be the horizontal measured length of pipeline in place from centerline of manhole to centerline of manhole. Measurement shall be by the linear foot with no deductions made for manholes, fittings or valves. The measurement for depth of gravity sewers shall be made vertically from the existing ground surface above the pipeline to the invert of the sewer.

2. The length of pipe and fittings (force main or low pressure sewer) to be paid for shall be the measured length of pipeline in place. Measurement shall be by the linear foot with no deductions made for fittings or valves.

3. Measurement for service connections shall be by the linear foot with no deductions made for fittings or valves.

   a. Measurement for sewer service connections shall be the horizontal measured length of pipeline in place from the face of the wye, tee or chimney to the terminus of the service pipeline.

   c. For connections to existing services, measurement shall be as stated above with a minimum payment of five (5) linear feet.

4. Measurement for wyes, tees, blow offs, air vents (manual or automatic), service connections and the like shall be per each installation, as approved by the Engineer.

C. Payment. Payment for furnishing and installing pipelines and associated fittings of the various types, diameters and depths listed in BID FORM, shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Only seventy-five (75) percent of the price bid per linear foot of pipeline shall be paid for upon its installation, the balance shall be withheld until such time as pipeline(s) have been successfully flushed and tested (as required), accepted by the Owner for incorporation into the existing pipeline system and the site(s) has been fully restored. This percentage is exclusive of normal Contract retainage.

2. An additional five (5) percent shall be withheld until such time as the complete system has been cleaned and televised with records accepted by the Owner. This percentage is exclusive of normal Contract retainage.

3. The Contractor shall provide water for flushing and testing (as applicable) for each section of pipeline (transmission main and force main only) installed. Water utilizing the Owner's water system may be available, however the Owner does not guarantee that its water supply will be available at any time during the duration of the Project. If available, water required for testing, puddling and/or jetting of trenches shall be provided by the Owner at no cost to the Contractor. All water shall be metered and the use of backflow prevention device(s) shall be required as approved by the Owner.

4. Payment for furnishing and installing fittings, restraints, solid sleeves, flexible couplings, transition couplings and the like shall be made under and included in the prices bid per linear foot.

5. Payment for service connections including fittings and/or valves shall be made at the unit price bid per linear foot.

6. Payment for sewer service wyes or tees shall be made at the unit price bid for each approved installation. Payment will be made without regard to size.

ITEM 3. PRECAST CONCRETE MANHOLES AND STRUCTURES

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include excavation, installation, steel reinforced copolymer polypropylene plastic steps, lifting rings, sealing materials in horizontal joints, pipe penetrations, dampproofing, invert, electrical and mechanical equipment, valves and fittings as specified and/or shown on the Contract Drawings, backfill, mancatchers on manholes over twenty (20) feet in depth, removal and legal disposal of existing structures to be replaced, and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing precast concrete manholes shall be as follows:

1. For sewer and drain manholes, measurement for depth shall be from the top of frame to the lowest invert in the manhole, as approved by the Engineer.

2. For air release and flushing/drain manholes, measurement shall be per each installation, regardless of depth, as approved by the Engineer.

3. For sump drain manholes and catch basins, measurement shall be from the top of frame to the lowest invert or sump in the structure, as approved by the Engineer.

C. Payment. Payment for furnishing and installing precast concrete manholes listed in BID FORM shall be made at the unit prices bid under the applicable divisions of this Bid Item.

1. Payment for air vacuum and air release valve and/or flushing drain manholes shall be per each approved installation.

2. Only seventy-five (75) percent of the price bid for each manhole shall be paid for upon its installation, the balance shall be withheld until such time as the manhole has been successfully tested and accepted by the Owner. This percentage is exclusive of normal Contract retainage.

3. An additional ten (10) percent shall be withheld until such time as the invert, manhole steps, pig catchers, and mancatchers have been installed and accepted by the Owner. This percentage is exclusive of normal Contract retainage.

4. An additional twenty (20) percent shall be withheld until such time as the mechanical equipment, valves and fittings in the air release and/or drain manholes have been installed and accepted by the Owner. This percentage is exclusive of normal Contract retainage.

ITEM 4. MANHOLE FRAMES AND COVERS

A. General. The prices bid under each division of Item 4 shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include setting frames and covers to existing grade initially and resetting frames and covers to final grade prior to final pavement restoration and all other incidental Work relative thereto.

B. Measurement. Measurement for furnishing and installing manhole frames and covers shall be per each installation as approved by the Engineer.

C. Payment. Payment for furnishing and installing manhole frames and covers of the various types and sizes listed in BID FORM shall be made at the unit prices bid per each under the applicable divisions of Item 4.

ITEM 5. MANHOLE DROP CONNECTIONS – Not Used

ITEM 6. CHIMNEYS

A. General. The price bid under Item 6 shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include excavation, vertical piping, wye fittings, caps, concrete encasement, and all other incidental Work relative thereto.

B. Measurement. Measurement for chimneys shall be from the top of the chimney to the top of the wye fitting for each installation as approved by the Engineer.

C. Payment. Payment for chimneys listed in BID FORM shall be made at the unit price bid under Item 6.

ITEM 7. MISCELLANEOUS CEMENT CONCRETE

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, and any other incidental Work relative thereto.

B. Measurement. Measurement of miscellaneous cement concrete shall be the actual cubic yardage placed as approved by the Engineer.

C. Payment. Payment for miscellaneous cement concrete listed in BID FORM shall be made at the unit price bid per cubic yard under this Bid Item.

1. Payment for concrete used for manhole bases, joints and inverts, for setting frames and covers, for manhole drop connections and for chimneys shall be included as specified under the applicable Bid Item.

ITEM 8. ROCK AND/OR BOULDER EXCAVATION

A. General. The unit price for rock and/or boulder excavation under Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include excavation, drilling and blasting; drilling and splitting; use of hydraulic/pneumatic hammers, pre-blast survey(s), permit(s) and license(s), vibration monitoring, removal and legal disposal of rock and/or boulders, furnishing and placing replacement material, backfilling and compaction, and any other incidental Work relative thereto.

B. Measurement. Measurement of rock and/or boulder excavation shall be made based on the volume removed and replaced as approved by the Engineer computed as follows:

1. Only boulders greater than one (1) cubic yard in volume, defined by the Engineer as removable only by blasting, shall be measured and paid for under this Bid Item. Measurement shall be based on the length, width and depth of boulders excavated within the trench limits.

2. Rock in pipe trenches shall be measured from its surface to a point six (6) inches below the invert of the pipe and as follows:

a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

3. Rock or boulders encountered in other excavations, which are to be paid for separately, shall be measured from its surface to a point six (6) inches below the base of structure and to a width of one (1) foot outside the face of the structure.

4. Where more than one (1) pipe is installed in the same trench, payment shall be made on the basis of a common trench with the maximum trench width of seven (7) feet.

C. Payment. Payment for rock and/or boulder excavation listed in BID FORM shall be made at the unit price bid per cubic yard under this Bid Item.

1. No additional payment will be made for frost removal or for any other materials encountered in the excavations, no matter how stiff or compact of consistency, even if blasting is required for removal. Soft or disintegrated rock that can be removed without the use of explosives shall not be paid for under this Bid Item.

2. No additional payment will be made for rock and/or boulder excavation where existing utilities are removed and relaid to facilitate the Work within the trench limits defined hereinbefore.

3. Masonry or concrete structures encountered during the course of constructing the Work, which require blasting for removal, shall be paid for subject to the limits and conditions described herein.

4. No payment will be made for excavation of rock and/or boulders beyond the specified limits.

The unit price for rock and/or boulder excavation shall be a minimum of $65 per cubic yard which shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include excavation, drilling and blasting; drilling and splitting; use of hydraulic/pneumatic hammers, pre-blast survey(s), permit(s) and license(s), vibration monitoring, removal and legal disposal of rock and/or boulders, furnishing and placing replacement material, backfilling and compaction, and any other incidental Work relative thereto.

ITEM 9. REPLACEMENT OF UNSUITABLE MATERIAL

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include excavation, sheeting or shoring not ordered left in place, dewatering, removal and legal disposal of unsuitable materials, filter cloth, furnishing and placing replacement materials, transportation, backfilling, compaction and any other incidental Work relative thereto.

B. Measurement. Measurement for replacement of unsuitable material above and below trench grade and/or subgrade shall be made based on the volume removed and replaced as approved by the Engineer and as follows:

1. Unsuitable material below trench grade shall be measured from a point six (6) inches below the invert of pipe to the bottom of the excavation and as follows:

a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

2. Unsuitable material above trench grade shall be measured from a point one (1) foot plus the thickness of permanent pavement thickness below the existing pavement surface or from a point six (6) inches below the existing unpaved surface to a point one (1) foot above the pipe and as follows:

a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

3. Unsuitable material below precast concrete manholes shall be measured from a point six (6) inches below the base of the manhole to the bottom of the excavation and to a width of two (2) feet plus the outside diameter of the manhole.

4. Unsuitable material below foundations for structures shall be measured from the bottom of foundation varying in width on a forty-five (45) degree angle down from the bottom of foundation to a depth approved by the Engineer.

C. Payment. Payment for replacement of unsuitable material above and below trench grade and/or subgrade listed in BID FORM shall be made at the unit price bid per cubic yard under the applicable division of this Bid Item.

1. No payment will be made for replacement of unsuitable material above trench grade when suitable excess excavated material is available from other excavations made under this Project.

2. Bedding material placed from a point six (6) inches below the invert of pipe, to a point one (1) foot above the top of the pipe shall be included for payment under the applicable pipe laying Bid Item.

3. When more than one (1) pipe is installed in the same trench, payment will be based on a common trench with a minimum width of seven (7) feet.

4. No payment will be made for unsuitable material replaced beyond the limits approved by the Engineer.

ITEM 10. EXPERIMENTAL EXCAVATION

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include notification of utility owners, machine and/or hand excavation to locate utilities, backfill, compaction, maintaining utility marking locations, repair to utilities damaged while performing experimental excavations, temporary bituminous concrete patch, furnishing assistance to the Engineer and all other incidental Work relative thereto.

B. Measurement. Measurement of experimental excavation shall be made based on the volume excavated and backfilled as approved by the Engineer.

C. Payment. Payment for experimental excavation listed in BID FORM shall be made at the unit price bid per cubic yard under this Bid Item. No payment will be made for any cost associated with damages caused to existing utilities made during the performance of experimental excavation operations.

ITEM 11. FILL FOR EMBANKMENTS – Not Used

ITEM 12. SHEETING AND/OR SHORING ORDERED LEFT IN PLACE – Not Used

ITEM 13. SOILS COMPACTION TESTS

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include excavation, sampling, sieve analysis, laboratory and field testing, backfill, compaction and any other incidental Work relative thereto.

B. Measurement. Measurement of compaction testing shall be per each test as approved by the Engineer.

C. Payment. Payment for soils compaction tests listed in BID FORM shall be made at the unit price bid per each under this Bid Item.

1. For the purpose of payment, a test shall include, but not be limited to, exploratory excavation, sieve analysis, modified proctor, density test, backfill and compaction of excavations.

2. No payment will be made for any test that fails to meet the specified compaction requirements.

ITEM 14. ROAD BASE COURSE MATERIAL

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include transportation, preparation of sub-grade, placement, grading, compaction and any other incidental Work relative thereto.

B. Measurement. Measurement of road base course material as a subbase for permanent resurfacing shall be based on the approved volume furnished and placed as approved by the Engineer computed as follows:

1. The length of main trench shall be defined as the length of roadway surface disturbed by the pipeline Work. The length of service trench shall be defined as the length of roadway surface disturbed by the service line Work less three (3) feet from the centerline of the main sewer or water pipeline trench.

2. The width of main or service trench shall be defined as follows:

a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths of twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

3. When more than one (1) pipe is installed in the same trench, payment will be based on a common trench with a maximum width of seven (7) feet.

4. The thickness of road base course material in local roadways shall be twelve (12) inches, unless otherwise specified or approved by the Engineer.

5. The thickness of road base course material in State Roadways shall be equal to the thickness of the existing undisturbed road base course material adjacent to the trench.

6. No payment will be made for road base course material when suitable excess excavated material is available from other excavations made under this Project.

C. Payment. Payment for furnishing and placing road base course material listed in BID FORM shall be made at the unit price bid per cubic yard under this Bid Item.

ITEM 15. PAVEMENT RESTORATION

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools, and materials necessary to complete the Work as specified, which shall include, preparation of subgrade, cutting and recutting of bituminous and cement concrete pavement, reshaping of the roadway surface and/or shoulder, furnishing and placing bituminous concrete leveling course, furnishing and placing bituminous concrete, maintenance and protection of roadway surfaces, repainting of traffic control lines, cold planing bituminous concrete surfaces, infra-red heat treatment of bituminous concrete joints and all other Work incidental thereto and all other Work incidental thereto.

B. Measurement. Measurement for pavement restoration shall be as follows:

1. Temporary Bituminous Concrete Trench Pavement.

a. Measurement for main trench pavement will be made based on the actual length of roadway surface disturbed by the pipeline Work. The length of service trench shall be defined as the length of roadway surface disturbed by the service line Work less three (3) feet from the centerline of the main sewer or water pipeline trench.

b. The maximum width of main or service trench eligible for payment shall be defined as follows:

(1) For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths of twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

(2) For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

c. The thickness of temporary bituminous concrete trench pavement in local roadways shall be two (2) inches or as approved by the Engineer. The thickness of temporary bituminous concrete trench pavement in state roadways shall be as specified in the road opening permit for the Project. All costs associated with meeting these requirement outside the limits described above shall be borne by the Contractor.

2. Permanent Bituminous Concrete Trench Pavement. Measurement for main trench pavement will be made based on the actual length of roadway surface disturbed by the pipeline Work. The length of service trench shall be defined as the length of roadway surface disturbed by the service line Work less three (3) feet from the centerline of the main sewer or water pipeline trench. The maximum width of main or service trench eligible for payment shall be defined as follows:

    a. For pipe twenty-four (24) inches or less in diameter a width of seven (7) feet for depths of twelve (12) feet or less and a width of nine (9) feet for depths greater than twelve (12) feet.

    b. For pipe greater than twenty-four (24) inches in diameter a width of five (5) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of seven (7) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

    c. The thickness of permanent bituminous concrete trench pavement in local roadways shall be equal to the thickness of the existing undisturbed surface adjacent to the trench or four (4) inches, whichever is greater or as approved by the Engineer.

3. Measurement of width for permanent bituminous concrete pavement for trenches with more than one (1) pipe laid in the same trench shall be treated as a common trench with a maximum trench width of nine (9) feet, unless otherwise approved by the Engineer.

4. Permanent Bituminous Concrete Overlay Pavement. Measurement for permanent bituminous concrete overlay pavement will be made based on the actual length and width of roadway overlaid as approved by the Engineer. The thickness of permanent bituminous concrete overlay pavement in local roadways shall be equal to two (2) inches or as approved by the Engineer.

5. Miscellaneous Bituminous Concrete. Measurement for miscellaneous bituminous concrete placed where directed by the Engineer shall be by the ton based on certified weight slips delivered daily to the Engineer.

C. Payment. Payment for pavement restoration listed in BID FORM shall be made under the applicable divisions of this Bid Item.

1. The factor of 0.055 tons per square yard per inch of thickness shall be used for weight-volume conversions for bituminous concrete.

2. Certified weight slips for all bituminous concrete delivered to the site(s) and certified volume slips for all controlled density fill delivered to the site(s) shall be submitted to the Engineer on a daily basis.

3. Payment for furnishing and placing permanent bituminous concrete pavement shall be made at the unit price bid per ton computed using one of the following methods:

    a. Method 1 (Measured in Place): The Engineer shall multiply the pavement area by the specified pavement thickness by the factor to obtain the tonnage of bituminous concrete.

b. Method 2 (Delivered): Certified weight slips shall be used. Any bituminous concrete placed outside the payment limits, unless approved by the Engineer, shall be deducted (using Method 1) from the total tonnage obtained from the certified weight slips.

c. Payment for furnishing and placing temporary and permanent bituminous concrete will be made based on the number of tons obtained using either Method 1 or Method 2, whichever is less.

4. No additional payment will be made beyond the payment limits noted or for maintenance or repair of trenches.

5. Payment for joint sealant and/or tack coat shall be included under the applicable division of this Bid Item for bituminous concrete Work.

6. Payment for adjusting frames and covers, valve boxes and all other castings prior to placement of permanent bituminous concrete pavement shall be included under the applicable division of this Bid Item for bituminous concrete Work.

7. Payment for reshaping of roadways and/or road shoulders, roadway reclamation, regrading and compaction of roadway base course materials and or providing leveling course over settled trenches shall be included under the applicable division of this Bid Item for bituminous concrete Work.

8. Payment for miscellaneous bituminous concrete whether placed by machine or by hand, for leveling of existing roadways, driveway aprons, sidewalks, and other areas outside the trench limits will be made at the unit price bid per ton.

ITEM 16. REMOVE AND RELAY OR REPLACE EXISTING UTILITIES

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include transportation, handling and dispersal of materials, removal and legal disposal of excess materials, furnishing and installation of new replacement materials (including but not limited to pipe and accessories, couplings, fittings, manholes and catch basins), excavation (excluding that which is specified to be paid for separately), backfill above trench grade including all bedding materials (excluding material used to replace unsuitable material and road base course material), compacting trenches, sheeting and shoring not ordered left in place, testing (excluding soil compaction tests specified to be paid for separately), daily cleanup, restoration of all areas disturbed by the Contractor’s operations that are not included for payment under another Bid Item, and all other incidental Work relative thereto.

B. Measurement. Measurement for removal and relaying or replacing existing utilities shall be as follows:

1. Measurement for the removal and relaying or replacement of existing water, sewer and/or storm drain pipelines and appurtenances, within the allowable trench width only, will be made by multiplying the inside diameter of the relaid or replaced pipeline by the length of relaid or replaced pipeline. For measurement purposes, the allowable trench width will be defined as follows:

a. For pipe twenty-four (24) inches or less in diameter a width of five (5) feet for depths twelve (12) feet or less and a width of seven (7) feet for depths greater than twelve (12) feet.

b. For pipe greater than twenty-four (24) inches in diameter a width of three (3) feet plus the inside diameter of the pipe for depths of twelve (12) feet or less and a width of five (5) feet plus the inside diameter of the pipe for depths greater than twelve (12) feet.

2. Measurement for removal and resetting or replacement of manholes and catch basins will be made by multiplying the inside diameter of the manhole or catch basins by its height.

C. Payment. Payment for the removal and relaying or replacement of existing water, sewer and/or storm drain pipelines and appurtenances listed in BID FORM shall be made at the unit prices bid per inch-foot under the applicable divisions of this Bid Item.

1. Payment will only be made for the removal and relaying or replacement of existing water, sewer and/or storm drain pipelines and appurtenances when (1) such utilities are removed and relaid or replaced as a result of conflicts in elevation with the grade of the new pipelines or (2) the length of such existing utilities within the allowable trench width that cross above the new pipeline is greater than two and one-half (2.5) times the width of the allowable trench limit or (3) such utilities lie completely within the allowable trench width and the existing utility invert is a minimum of two (2) feet above the crown of the new pipeline as approved by the Engineer.

2. No payment will be made for the removal and relaying or replacement of utilities other than water mains, sewer mains, force mains or storm drains.

3. No payment will be made for the removal and relaying or replacement of utilities which lie either partially or completely beyond the allowable trench width.

4. Payment for removal and resetting or replacement of manholes and catch basins shall include resetting frames and covers or grates.

ITEM 17. UNIFORMED TRAFFIC POLICE OFFICERS

A. General. Payment for the services of uniformed police officers shall be made at the prevailing rates of pay for special duty details in effect at the time of services, for each permanent, special or reserve officer and for graduated rank. Uniformed police officers shall be paid directly by the Owner. The Contractor is responsible for coordination of the police details. Refer to GENERAL INFORMATION.

ITEM 18. ENGINEER'S FIELD OFFICE

A. General. The prices bid under each division of Item 18 shall be considered as fair compensation for all labor, equipment, tools and materials necessary to furnish, install maintain and remove the Engineer's Field Office as specified, including all other incidental Work relative thereto. The Engineer shall notify the Contractor when the Engineer’s Field Office is to be removed from the site.

B. Measurement. Measurement for furnishing, installing, maintaining and removing the Engineer's Field Office shall be as follows:

1. Measurement for payment for furnishing, installing and subsequent removal of the Engineer's Field Office shall be for one (1) complete and acceptable unit as approved by the Engineer.

2. Measurement for payment for maintaining the Engineer's Field Office shall be per week as approved by the Engineer.

C. Payment. Payment for furnishing, installing, maintaining and subsequent removal of the Engineer's Field Office listed in BID FORM shall be made at the lump sum and unit prices bid under the applicable divisions of Item 18.

1. Payment for furnishing, installing and removal of the Engineer’s Field Office shall be made at the lump sum price bid under the applicable division of Item 18. The lump sum price bid shall include transporting, mobilization, demobilization, utility connection fees, permits, licenses, insurance, and all other labor, materials, and equipment required to furnish the Engineer's Field Office as specified. An amount of seventy-five (75) percent of the amount bid (exclusive of normal contract retainage) will be made when the Engineer’s Field Office is ready for occupancy and use on the Project. The remaining twenty-five (25) percent (exclusive of normal contract retainage) will be made following the removal of the Engineer’s Field Office from the Project.

2. Payment for maintaining the Engineer’s Field Office shall be made at the unit price bid per week under the applicable division of Item 18. Maintaining the Engineer's Field Office shall include all maintenance, rental fees, utility charges, sanitary fees, equipment rental charges, and all other costs related to the weekly operation of the Engineer’s Field Office. Payment will be made for those periods of time that the Engineer has directed the Contractor to provide the Engineer’s Field Office. No payment will be made for the Engineer’s Field Office that was not requested by the Engineer, or that remained on the Project after the Engineer notified the Contractor to remove it.

3. The Owner reserves the right to delete from the Work any or all divisions of Item 18 without penalty.

4. No payment shall be made once the Contractor’s time for completion has been reached.

ITEM 19. ENVIRONMENTAL PROTECTION

A. General. The prices bid under each division of this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified, which shall include furnishing, installing, maintaining and removing sedimentation control barriers and structures and all other incidental Work relative thereto.

B. Measurement. Measurement for Environmental Protection shall be as follows:

1. Measurement for furnishing, placing, maintaining, and removal of sedimentation barriers shall be per linear foot of measured length of in-place barrier as approved by the Engineer.

2. Measurement for furnishing, placing, maintaining, and removal of sedimentation control structures shall be per each as approved by the Engineer.

C. Payment. Payment for Environmental Protection listed in BID FORM shall be made under the applicable divisions of this Bid Item as follows:

1. Payment for sedimentation control barriers shall be made at the unit price bid per linear foot.

2. Payment for sedimentation control structures shall be made of the unit price bid per each approved installation.

3. No additional payment will be made for maintaining or replacing sedimentation barriers or control structures during the course of the Work.

ITEM 20. DEWATERING

A. General. The price bid under this Bid Item shall be considered as fair compensation for all labor, equipment, tools and materials necessary to complete the Work as specified which shall include Work performed by the Contractor, Contractor's Subcontractor(s) or Consultants, design, permits, installation, operation, maintenance and removal of the dewatering system (including but not limited to pumps, well points, header pipes and approved discharge point preparation and restoration), legal disposal of all water discharged during the operation of the dewatering system, restoration of all areas disturbed by the Contractor's operations and all other incidental Work relative thereto.

B. Measurement. Measurement for dewatering shall be by the linear foot of pipe trench dewatered as approved by the Engineer.

C. Payment. Payment for dewatering listed in BID FORM shall be made at the linear foot price bid under this Bid Item and as follows:

1. No payment will be made for dewatering systems utilized within the limit of the trench excavation.

ITEM 21. SAMOSET STREET SEWER SYSTEM EXPANSION PUMP STATION

A. General. The prices bid under each division of Item 21 shall be considered as fair compensation for all labor, equipment, tools, and materials necessary to complete the Work, as specified, located within the limit of Work shown for the construction of the pumping station on the Contract Drawings. This shall include all Work performed by the Contractor, Subcontractor(s) or Contractor's Consultant(s) for the construction of a complete pumping station including installation of planting materials, utility company coordination, and all other incidental Work relative thereto. No other payment Item will be used for compensation of Work performed within the limit of work line shown on the Contract Drawings for Item 21.

B. Measurement

1. Measurement for pumping station construction shall be made based on a percentage of the total lump sum amount bid under Item 21, as approved by the Engineer.

2. Measurement for utility charge allowance(s) shall be based on the actual paid invoices by the Contractor to each utility company. The following utility allowances shall be included in each subdivision of Item 21: Planting Materials at $15,000; Electrical at $20,000; Telephone at $7,500; and Gas at $20,000.

C. Payment. Payment for pumping station construction listed in BID FORM shall be made at the lump sum price bid or actual utility cost incurred under the applicable division of Item 21.

1. Payment for pumping station construction shall be made as follows: An amount of 60 percent of Item 21 (exclusive of normal contract retainage) shall be made when the pumping station is completely constructed which includes all site and utilities Work. The remaining 40 percent (exclusive of normal contract retainage) shall be made following acceptance of the pumping station by the Owner, including startup and testing, training of Owner personnel, delivery and approval of Operation and Maintenance Manual(s) and receipt by Owner of all specified spare parts.

2. Payment for planting materials and utility companies' charges shall be made based on the actual charges paid to each utility by the Contractor. An amount of 100 percent of each paid invoice (no retainage) will be made to the Contractor based on paid invoice receipts.

PART 2 PRODUCTS – Not Applicable

PART 3 EXECUTION – Not Applicable

END OF SECTION

SECTION 01030

SPECIAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE

A. The Work of this section includes the furnishing of all labor, materials, tools and equipment required to perform Special Requirements as specified herein.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for Work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT and as follows:

1. All costs associated with locating, maintaining location marks, excavation, refilling, compaction, repairing utilities broken due to the Contractor's operations, time delays relative to existing utilities and all other Work associated with utilities shall be included for payment under the applicable pipe laying item included in the BID FORM.

2. All costs associated with the legal disposal of excess materials shall be borne by the Contractor.

3. No additional payment will be made for corrective work associated with furnishing and installing bedding materials for refill of excavations carried to grades lower than specified. If inadequate dewatering methods cause softening of subgrade areas then remove the unsuitable material and replaced with common fill and shall be borne by the Contractor.

4. No payment will be made for temporary shoring of trench walls utilizing trench boxes and/or steel plates. Where timber or steel sheeting is used and is not specified to be paid for separately and ordered left in place by the Engineer, the Contractor has the option of leaving it in or removing it after it has been cut off one (1) foot above the top of the pipe.

5. Pay all fees for permits associated with blasting operations. Unauthorized excavations in rock, or excavations made beyond or below the specified limits shall be refilled and compacted with common fill and shall be borne by the Contractor. Perform blasting operation(s) in such a manner that no existing utilities are disturbed. All damage to existing utilities or roadway surfaces outside the trench limits caused by the Work of the Contractor or its Subcontractor(s) shall be repaired and/or replaced immediately and shall be borne by the Contractor.

6. No additional payment will be made for the relocation and/or support of any obstruction encountered along the line of Work.

7. Testing, puddling and/or jetting of trenches utilizing the Owner's water system may be available, however the Owner does not guarantee that its water supply will be available at any time during the duration of the Project. If available, water required for testing, puddling and/or jetting of trenches shall be provided by the Owner at no cost to the Contractor. Location of hydrants used shall be approved by the Owner. All necessary piping, hoses, fittings, and the like shall be provided by the Contractor and shall be borne by the Contractor. All water shall be metered and the use of backflow prevention device(s) shall be required as approved by the Owner.

8. Provide detailed plan(s) to the Owner and/or appropriate governing body for all proposed detours and/or partial roadway closings made necessary by the Work. Obtain written approval for all proposed detours and/or partial roadway closings prior to the start of Work. No payment will be made for Work performed in areas of the Project that require an approved traffic management plan until it has been secured.

9. All costs associated with repairing settlement of trenches shall be borne by the Contractor.

10. All costs associated with meeting the requirements of all environmental permits, state highway permits and the removal and/or reinstallation of existing utilities shall be borne by the Contractor and shall be included for payment under the applicable pipe laying item included in the BID FORM.

11. The Contract contains price adjustments for Liquid Asphalt, Portland Cement, Diesel, and Gasoline. For this Project the base prices are as follows: Liquid Asphalt at $585.00 per ton (January 2015); Portland Cement at $123.78 per ton (January 2015); Diesel at $2.534 per gallon (December 2014); and Gasoline at $2.081 per gallon (December 2014). MassDOT posts the Price Adjustments on their Highway Division's website at http://www.massdot.state.ma.us/highway/DoingBusinessWithUs/Construction/PriceAdjustments.aspx

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. "Work" shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SPECIFICATIONS AND DRAWINGS

A. All Work shall conform to these specifications and the accompanying drawings entitled:

CONTRACT DRAWINGS
FOR
CONTRACT NO. 2014-PHASE 1
SAMOSET STREET SEWER SYSTEM EXPANSION
PLYMOUTH, MASSACHUSETTS

Dated June 2014 (Revised January 2015) consisting of 34 sheets, all made by the Engineer, on file with the Owner, and any changes, drawings, plans, and directions that may be furnished from time to time by the Engineer.

1.05 PROGRESS OF WORK

A. Promptly start and continue actual construction Work under this Contract with the necessary equipment to properly execute and complete the Work in the specified time. No cessation of construction activities will be allowed without the written approval of the Owner.

B. Furnish to the Engineer a progress schedule for the Work prior to the start of construction.

1.06 DETOURS AND ROAD ACCESSIBILITY

A. Contact the responsible heads of the Fire Department, Police Department, and other appropriate governing bodies of the municipality having jurisdiction over all or part of the proposed Project, in order to obtain all necessary permits and determine the requirements of these governing bodies, with regards to traffic control.

B. There are no guarantees that total roadway closures will be permitted. Incorporate into the construction schedule the ability to maintain one (1) lane of traffic at all times during the execution of the Work and complete the Work within the Completion date. Where the roadway under construction is the only means of vehicular access to a particular area provide continual access to the area for residents and emergency vehicles. Wherever detours are permitted, the size, construction and location of signs shall conform to local and state requirements and/or standards. Detour routes shall be adequately posted to assist the motorist to return to the normal route of travel for the duration of the Work and for a minimum of two (2) weeks prior to the start of construction in the areas of the Project affected by the Work.

C. Detours and road accessibility shall be in accordance with SECTION 01570, TRAFFIC MANAGEMENT AND MAINTENANCE.

1.07 CHANGE IN AMOUNT OF WORK

A. The Owner reserves the right to increase or decrease the amount of any item of the Work listed as may be found desirable or necessary during the carrying out of this Contract and the unit prices included in BID FORM shall apply without change to such variation in the quantity of each of the Bid items to the extent provided by law.

1.08 SCOPE OF WORK AND SEQUENCE OF CONSTRUCTION

A. The Work to be done under this Contract consists of furnishing and installing wastewater infrastructure as specified and/or as shown on the Contract Drawings.

1. The Work consists of furnishing and installing approximately 5,700 linear feet of 8-inch to 15-inch PVC gravity sewer and appurtenances, approximately 2,800 linear feet of 10-inch D.I. force main and appurtenances, and 1 wastewater pumping station all to provide wastewater service to the Samoset Street Area.

2. It is anticipated that the Work of the Project will be completed within 250 calendar days, due to winter conditions and work restrictions, leading to a total of 180 on-site working days.

3. Temporary roadway closures and detours for through traffic will not be allowed for Work in these roadways. All costs associated with shall be paid be the Contractor.

4. Construction shall occur during three construction periods: (a) Work shall not occur prior to April 6, 2015 (except as noted) and shall be completed by November 20, 2015; (b) Maintenance of Trenches between November 21, 2015 and May 14, 2016; and (b) Work shall not occur prior to May 15, 2016 and shall be completed by June 15, 2016.

a. Between Notice to Proceed and April 3, 2015

(1) Prepare, submit and receive approval of all shop drawings required under this Project prior to mobilization to the project site, except as noted.

(2) Perform preconstruction video.

(3) Establish roadway grades along the entire length of each roadway in accordance with SECTION 02503, PAVING, CURBING, SIDEWALKS, AND ROADWAYS. Submit and receive written approval from the Engineer prior to the start of construction.

(4) Establish Temporary Construction Site; obtain, received and protect all materials to be installed; and set-up Engineer’s trailer.

b. Between April 6, 2015 and November 20, 2015

(1) Perform installation of pipelines (main lines, and service lines, and force main).

(2) Perform installation of Pump Station.

(3) Clean and televise inspect of all sewers lines.

(4) Place bituminous concrete trench pavement (main line and services lines).

b. Between November 21, 2014 and May 14, 2016

(1) Maintain trenches.

b. Between May 15, 2016 and June 15, 2016

(1) Place full width bituminous concrete pavement (top course) of all existing bituminous concrete roadways including leveling course.

(2) Cleanup and loam and seed.

B. For the protection of life and property all backfilling operations shall follow closely behind pipe laying. Insure that no excavation is left open, unguarded, or water filled during any period of time when Work is not actually in progress. It is the purpose and intent that all excavations and backfill, including consolidation operations, and temporary surfacing within an area be accomplished expeditiously before proceeding to other Work areas.

C. The Owner reserves the right to schedule the Work at any location within the Project area. At the same time the Owner may schedule the suspension of Work at any location. Construction in seasonally heavily traveled roadways shall be avoided during the heavily traveled period.

D. A portion of the Work of this Contract is located within the buffer zones of bordering vegetated wetland, a bank and land under a water body and/or waterway. The Owner has obtained an Order of Conditions from the local Conservation Commission. Meet all of the requirements of SECTION 01140, ENVIRONMENTAL PROTECTION and the Order of Conditions included in DOCUMENT 00858, SPECIAL CONDITIONS – PERMITS AND LICENSES. All costs associated with this Work shall be borne by the Contractor and paid for as specified in SECTION 01025, MEASUREMENT AND PAYMENT.

E. The Work of this Contract may require existing utilities to be bypassed, removed and relaid. The Contractor shall pay for all costs associated with this Work at no additional cost to the Owner except as specified in SECTION 01025, MEASUREMENT AND PAYMENT.

F. The Owner has obtained various permits for this Project, which are included as DOCUMENT 00858, SPECIAL CONDITIONS – PERMITS AND LICENSES. Meet all requirements/conditions of these permits during the construction of this Project. All costs associated with this Work shall be borne by the Contractor and included in the prices bid under the applicable items of BID FORM.

G. Cleanup/restoration of all disturbed areas shall be completed each and every week or after a maximum of 500 linear feet of pipeline installation, throughout the duration of the Project. Cleanup/restoration consists of but is not limited to restoration of the area to preconstruction conditions, removal of all excess materials, removal of all pipe, fittings, manholes, removal of all construction equipment and materials, and removal of all construction debris. Failure to comply with this requirement may result in withholding the fair market value for the cleanup/restoration of all disturbed areas not completed from monthly payment requests until this requirement has been met.

H. Preblasting of ledge is not allowed on this Project. No payment will be made for ledge removal on this Project in areas were preblasting has occurred. All damage to existing utilities, roadways, and the like shall be repaired and/or replaced by the Contractor as approved by the Owner and shall be borne by the Contractor.

I. The control of dust shall be accomplished by the application of clean water utilizing the Owner's water system. However the Owner does not guarantee that its water supply will be available at any time during the duration of the Project. If available, water required for the control of dust shall be provided by the Owner at no cost to the Contractor. Location of hydrants used shall be approved by the Owner. All necessary piping, hoses, fittings, and the like shall be provided by the Contractor and shall be borne by the Contractor. All water shall be metered and the use of backflow prevention device(s) shall be required as approved by the Owner. The use of calcium chloride is not allowed.

J. Temporary paving, where applicable, is required to be placed each Friday throughout the duration of the Project and/or as directed by the Engineer. Include all costs associated with completing this Work under the applicable Bid item specified in SECTION 01025, MEASUREMENT AND PAYMENT. No payment will be made for temporary paving placed in areas not prepared in accordance with the Contract Documents. Failure to comply with this requirement may result in withholding the fair market value for temporary pavement not completed from monthly payment requests until this requirement has been met.

K. Except for an emergency condition as approved by the Owner in writing, premium wages will not be paid for Work performed on Saturday, Sunday, holiday or work days longer than eight (8) hours. All costs incurred by the Owner caused by the Contractor's Work performed on Saturday, Sunday, holiday or work days longer than eight (8) hours shall be borne by the Contractor which will be deducted from monthly payment requests.

L. No construction activity shall be allowed on the Project two working days prior to Memorial Day, July 4th, Labor Day, and Thanksgiving. All construction equipment and materials not incorporated in the Work to date shall be removed from the Work areas where construction activity is ceased. All excavations shall be backfilled and paved as specified and/or directed by the Engineer. Incorporate this requirement into the Project Schedule. Failure to comply with this requirement will result in no payment for work performed.

M. The Work of the Project involves roadways that are heavily traveled. The following requirements shall be maintained during the Work of this Project. Incorporate these requirements into the Project Schedule.

1. Complete all Work within each section of roadway (intersection to intersection) prior to proceeding to the next section or next roadway.

2. No Work shall be started on the Project until a detailed Project Schedule and Traffic Management Plan has been submitted to and approved by the Engineer. In addition, during the construction of the Project update the Project Schedule weekly and inform the Engineer, Owner and all other applicable utilities or other entities affected by the Work in writing of changes to the approved Project Schedule.

3. For additional requirements refer to SECTION 01570, TRAFFIC MANAGEMENT AND MAINTENANCE.

4. The Contractor shall provide four temporary variable message signs to provide advance warning to motorists prior to entering the construction area in accordance with SECTION 01570, TRAFFIC MANAGEMENT AND MAINTENANCE. The locations of the temporary variable message signs shall be as determined by the MassDOT and the Owner.

5. Failure to comply with this requirement will result in no payment for work performed.

N. Manhole sections, pipe, fittings, frames and covers, and other material and/or equipment shall not be stockpiled along roadways. The Contractor shall transport all materials and/or equipment from the temporary storage yard on a daily basis. The Contractor shall transport all unused materials and equipment to the temporary storage yard at the end of each work day. The Owner has set aside up to one acre, adjacent to the proposed pump station, to be utilized as a temporary storage yard. The final location of the temporary storage yard shall be approved by the Owner. The temporary storage yard shall also be used for the temporary buildings specified under SECTION 01500, TEMPORARY FACULTIES. The Contractor shall be responsible for clearing, grubbing, grading, providing of grading materials, permits, and full restoration of the temporary storage yard. The Contractor shall carry an allowance of $15,000 for furnishing plant materials (trees and shrubs) as part of the restoration of the temporary storage yard and Pump Station Site.

O. All equipment, material and supplies to be provided under this contract shall be American made.

P. All shop drawings shall be approved by the ENGINEER prior to any on-site construction activities occurring. Failure to comply with this requirement will result in no payment for work performed.

Q. Full mobilization by the Contractor at the project site shall occur, including manhole sections, pipe, fittings, frames and covers, and other material and/or equipment and all temporary facilities, except for the pumping station, prior to any on-site construction activities occurring. Failure to comply with this requirement will result in no payment for work performed.

1.09 EXISTING UTILITIES

A. The location and size of existing sewers, drains, culverts, water mains, gas mains, cables, service pipes, and other utilities shown on the Contract Drawings, were obtained from the results of surveys and existing records and are shown as approximate only, to guide the Bidders in the preparation of their Bid. The various utility companies will determine the location and depth of existing utilities by marking them out upon the ground and by experimental excavations by the Contractor prior to and as the Work progresses. The Contract Drawings do not show the exact location and depth of all utilities, nor do they show all utilities or the number of lines for each utility that may be encountered.

B. Assume that there are existing utility connections to each and every building or structure along the line of Work, whether they appear on the Contract Drawings or not. Notify the proper utility companies and obtain and preserve the marked location(s) of all existing utilities that may be encountered along the line of Work, until such time as such markings are no longer required.

C. Experimental trench excavations are to be made prior to commencing pipe laying operations. Excavate by hand as necessary in advance of the trenching equipment to determine the exact location and depth of each utility that may be encountered. Excavation equipment shall not be used within three (3) feet of the utility to be crossed. Continue to excavate by hand around these utilities after ascertaining their exact location and depth.

D. Experimental excavations shall be made at all existing potable water mains located within ten (10) feet of the proposed gravity sewer(s) and/or force mains prior to commencing trench excavations. Determine the exact location, materials of construction, size and elevation of these existing water main(s). The location and depth of the proposed gravity sewer(s) and/or force mains shown on the Contract Drawings shall be adjusted as approved by the ENGINEER, in order to maintain the required separation as specified in DOCUMENT 00852, SPECIAL CONDITIONS IN GENERAL, and to maintain a continuous upward or downward slope for force mains and to maintain the necessary line and grade for gravity sewers.

E. All utilities interfered with or damaged shall be replaced and/or repaired immediately. Carefully bed, tamp and fully consolidate refill material around and under all existing utilities encountered or crossed unless otherwise specified as approved by the Engineer.

F. Protection of all existing utilities in the vicinity of the Work and the assurance of uninterrupted service from existing utilities throughout construction is the responsibility of the Contractor.

G. In the event that the Contractor's Work results in damages to existing utilities, provide all necessary materials, equipment and labor necessary to satisfactorily repair damaged utilities immediately at no cost to the Owner.

H. Notify the Water Utility 24 hours prior to connecting to and/or bypassing any existing water main, or as required by the utility. Do not operate any existing water system valves. All such operations shall be coordinated with and performed by Water Utility personnel.

1.10 VISIT TO THE SITE (S)

A. Before submitting a Bid, visit the site(s), examine existing conditions and become thoroughly acquainted with the effort required to perform the Work.

B. Study the Contract Documents and compare the same with the information gathered during examination of the site(s), as no extra compensation will be authorized for extra Work caused by unfamiliarity with the site(s) and/or Contract Documents or the conditions peculiar to this Project.

1.11 DISPOSAL OF EXCESS MATERIAL

A. All surplus suitable material removed from the excavations not required for re-use in the Work and all unsuitable material removed from the excavations shall be legally disposed of on-site at the Town owned property on Fruit Street at a location determined by the Owner.

B. Legally dispose of all unsuitable material removed as part of the Work.

C. All topsoil shall remain the property of the Owner and shall be deposited as directed by the Owner within the limits of the municipality wherein the Work is being performed.

1.12 TECHNICAL SPECIFICATIONS

A. Where reference is made to ASTM, AWWA, AASHTO specifications or other associations, it is understood that the latest revisions as of the date of the Contract Documents shall apply.

1.13 PERMITS, FEES AND BONDS

A. Obtain and comply with all required permits, pay all fees and provide all bonds necessary to complete the Work as specified. Be solely responsible for performing any necessary acts and providing any materials required in order to comply with any and all terms and conditions set forth in any permits and licenses.

B. Refer to DOCUMENT 00858, SPECIAL CONDITIONS - PERMITS AND LICENSES for all permits, which have been obtained for the Project. The Owner has not obtained all permits and licenses required for this Project. The Contractor shall obtain and pay for any other permits required to complete the Project including but not limited to Road Opening Permit, Blasting, and Phase II General Stormwater Permit for small construction projects.

1.14 NOTIFICATION OF CONSTRUCTION

A. At least 5 business days prior to initiating excavation Work, notify the following entities, in writing, of where and when excavation(s) are scheduled.

1. Director of Public Works – (508) 830-4162, ext. 105

2. Sewer Department – (508) 830-4159

3. Water Department – (508) 830-4162, ext. 138

4. Highway Department - (508) 830-4162, ext. 101

5. Engineering – (508) 747-1620, ext. 120

6. Police Department - (508) 830-4220 (Business)

7. Fire Department – (508) 830-4213 (Business)

8. Dig Safe – (800) 322-4844

1.15 SUBMITTALS

A. Submit to the Engineer for approval, shop drawings, certificates of compliance and/or catalog cuts for all items to be furnished under this Contract. All submittals shall be provided in accordance with DOCUMENT 00700, GENERAL CONDITIONS.

B. Digital Videodisc Recording

1. Prior to the start of construction, video record, in color, the entire Project site(s) in the presence of the Engineer. Video recordings shall be in digital videodisc (DVD) format. Particular attention shall be made to the existing condition of roadway surfaces, curbing, berms, sidewalks, driveways, property bounds, landscaped areas, and any other items that might be affected by the Work.

2. Video recordings shall be of excellent quality including clear and concise audio descriptions of the existing site(s) conditions. A copy of the first completed video recording shall be furnished to the Engineer, prior to the start of construction, in order to establish the requirement for visual and audio quality. Two (2) copies of all video recordings shall be provided to the Engineer. Any recordings furnished which, in the opinion of the Engineer, are of poor quality or incomplete, shall be redone at no additional cost to the Owner.

3. Video recordings shall be made by the Contractor in the present of the Owner/Engineer.

C. Utilize the Shop Drawing Transmittal Forms supplied by the Engineer for all required submittals.

1.16 BOUNDS AND PROPERTY MARKERS

A. Prior to initiating construction, engage an independent Registered Land Surveyor (in the State where the Project is located) to provide permanent reference points for all bounds and property markers along the line of the Work that may be disturbed during construction. Submit copies of all ties to the bounds and property markers to the Engineer prior to excavation at the site(s).

B. Any bounds or markers disturbed shall be replaced utilizing the services of a Registered Land Surveyor in the State where the Project is located. The cost of replacing markers disturbed by the Contractor's operations shall be at the Contractor's expense.

1.17 TWENTY-FOUR HOUR EMERGENCY SERVICE

A. Maintain a 24-hour, 7-day a week telephone service. The Contractor’s emergency personnel and equipment shall be within 30 minutes travel time to the Project site(s) in order to handle emergency requirements such as, but not limited to, settled trenches, clogged drains, and rain damage and/or any other emergency situation relating to the Contractor’s Work. A list of the personnel and their telephone numbers, pager numbers, and cell phone numbers, shall be submitted to the Engineer, the Owner and to the local Police and Fire Departments.

B. This requirement shall apply for the duration of the Project and shall be updated as necessary. This list shall be submitted on the Contractor's letterhead and shall state that should an emergency arise during the implementation of the Project, these people are to be contacted. Submit this letter to the Engineer prior to initiating construction.

1.18 UNIFORMED POLICE OFFICERS

A. Payment of uniformed police officers used for pedestrian and vehicle control on this Project are to be paid for directly by the Owner without any Contractor involvement other than the Contractor's input as to traffic control requirements, coordinating traffic details, and canceling of planned details.

B. Uniformed police officers are paid a four (4) hour minimum. If arrangements have been made for uniformed police officers and inclement weather or other factors prohibit Work, contact the Police Department no later than 5:30 a.m. of the day of scheduled Work to cancel the police detail.

C. Should the Contractor fail to notify the Police Department as required, the Contractor shall assume all costs for the four (4) hour minimum police details not canceled in time.

D. Separate billings will be issued by the Police Department for non-canceled police details and the Contractor shall pay such bills on a monthly basis.

E. No uniformed private security forces shall be employed in this capacity without the express written approval of the Owner.

1.19 HOURS OF OPERATION

A. The Contractor, including all subcontractors, materialmen, and all other relating to this Project, shall conform to the following Work schedule.

1. No outdoor activity on or adjacent to the site will be permitted before 7:00 a.m. or after 4:30 p.m., unless other arrangements are made with the Owner.

2. All outdoor activity shall be confined to Monday through Friday except for emergency conditions, which, if practical, shall be reviewed and approved by the Owner.

B. Refer to DOCUMENT 00700, GENERAL CONDITIONS for additional requirements.

1.20 DISPOSAL OF DEBRIS

A. During the prosecution of the Work, maintain the Project site(s) and adjoining areas in a neat and orderly manner and eliminate the accumulation of construction debris. A rubbish container shall be kept at the Project site(s) at all times and be emptied as required to prevent odors and vermin.

B. Remove all debris from the Project site(s) and legally dispose of the debris in accordance with federal/state/local regulations. Should the Contractor neglect or refuse to maintain the Project site(s) free of accumulated debris, the Owner reserves the right to have the service performed by others and cost thereof deducted from monthly progress payment requests.

C. At the conclusion of the Work, remove and legally dispose of any surplus excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from construction operations, and leave the entire Project site(s) of the Work in a neat and orderly condition.

1.21 RECORD DRAWINGS

A. Throughout the course of completing the Work, continually maintain a set of record drawings that incorporate all approved changes made by the Contractor and all subcontractors to the Drawings included in the executed Contract between the Owner and the Contractor. Clearly and concisely mark up the individual Drawings and/or incorporate sketches that show approved changes made during the execution of the Work. Following completion of the Work, incorporate all approved changes electronically into one (1) complete set of record drawings. Record drawings shall be complete in every way and shall show the full extent of the executed Work. Special attention shall be given to concealed Work. Change Orders, Addenda items and field changes shall be included where applicable. Additional specific requirements relative to record drawings may be called for in the individual sections of the Specifications. Submit a review copy to the Engineer for approval and make any revisions required by the Engineer in order to make the record drawings complete. After acceptance by the Engineer, deliver a full scale reproducible hard copy and a compact disk set of the record drawings to the Engineer.

B. Tie cards (8 ½ inches by 11 inches) of all exterior buried utilities such as but not limited to piping, tubing, conduits, wye/tee connections, fittings, and valves, shall be fully dimensioned both horizontally and vertically, so that the exterior buried utilities can be located in the field. A minimum of two (2) ties shall be provided for each item requiring a tie. Submit the tie cards on a weekly basis or as directed by the Engineer. If, in the opinion of the Owner and/or Engineer, insufficient data is provided to properly locate the exterior buried utilities, uncover the buried utilities and perform the necessary measurements and provide updated tie cards at no additional cost to the Owner.

C. An electronic copy of the Engineer's Auto Cad files shall be made available to the Contractor for the purpose of completing the required computer drafted record drawings.

1.22 PHOTOGRAPHS OF THE PROJECT

A. Once a month take 48 digital color photographs of the Work in progress. View and orientation of the photographs shall be as determined by the Engineer in the field.

B. Proofs of the digital color photographs shall be submitted to the Engineer for final selection of up to 24 photographs. If 24 photographs cannot be selected from the 48 proofs taken, as determined by the Engineer, then the Contractor shall take an additional 48 photographs for review at no additional cost to the Owner. Formally submit the 24 photographs selected by the Engineer as 8 inch by 10 inch color glossy prints on a monthly basis.

C. In the event that insufficient progress has been made in the previous month to justify the total number of photographs specified above, the Owner reserves the right to have additional views taken in any succeeding month so that the total number will be equal to 24 times the number of months in the Contract period.

D. Each digital photograph shall be identified by a neatly typed index given the Project's name Contractor's name, the date taken, the subject, and the orientation (looking north, looking south, etc.).

E. At the completion of the Contract, all digital images shall become the property of the Owner and shall be delivered to the Owner. Any view not properly identified or otherwise not acceptable will not be counted in the total number of photographs required.

1.23 INITIAL OPERATION OF NEW FACILITIES

A. Operation and maintenance manuals shall be submitted to the Engineer in accordance with DOCUMENT 00700, GENERAL CONDITIONS at least one (1) month prior to the scheduling of any manufacturers training.

B. Perform pressure and/or leakage testing of all pipelines, storage tanks and basins prior to prestart-up testing of all equipment and/or systems. Provide the initial filling of all pipelines, storage tanks and basins with potable water as necessary for start up of individual systems throughout the facility.

C. Initial start-up of new equipment and/or systems shall not commence until all of the manufacturers services, checkout, and training have been completed as approved by the Engineer.

D. Perform an 8 hour or less, if approved by the Engineer, prestart-up test of all individual equipment prior to incorporating equipment into their appropriate systems.

E. Perform an 8 hour or less, if approved by the Engineer, prestart-up test of all systems prior to conducting the performance test of the facility.

F. Provide all labor, power, chemicals, operations and maintenance from the initial start-up of the individual equipment and systems until the final performance test of the facility is accepted by the Owner as substantially complete at no additional cost to the Owner.

1.24 CONTINUOUS OPERATING CRITERIA

A. Conduct operations in such a manner and sequence that shall neither result in a disruption of the amenities, nor interfere with the functional organization and workings of existing facilities.

B. Furnish, install and operate any piping, equipment and appurtenances necessary to provide the temporary services, facilities, and bypasses required during construction including, but not limited to, bypass pumping, flow barriers and diversions.

C. The Owner will operate and maintain all existing systems and equipment. Notify and coordinate with the Owner all temporary modifications to existing facilities operations required for construction within, or interfacing with, the existing facilities. Operate and maintain all proposed facilities until such time as the Owner accepts them.

D. A carefully planned and detailed construction schedule must be submitted to the Engineer for approval before any construction starts, showing the proposed sequences of operation and the methods to be used for maintaining continued operations of existing facilities.

1.25 SCHEDULE OF VALUES

A. Submit a schedule of values for use in preparing the monthly progress payments described in the DOCUMENT 00700, GENERAL CONDITIONS.

B. The schedule of values shall include the following:

1. Unit Prices by Individual Item

2. Allowance Prices by Individual Item

3. Change orders by individual items shall be added as approved by the Owner.

C. In addition to the above, a schedule of values for the pumping station shall include the following breakdown:

1. Shop Drawings (10 percent of equipment value)

4. Equipment

5. Installation

6. Manufacturers’ Checkout and Startup (2 percent of equipment value)

7. Equipment testing (10 percent of equipment value)

8. Manufacturers' Training of Owner Personnel (1 percent of equipment value)

9. Spare Parts (1 percent of equipment value)

10. Operation and Maintenance Manuals (1 percent of equipment value)

D. The schedule of values shall be submitted to the Engineer for review and approval at least 30 calendar days prior to the first progress payment request. The acceptable schedule of values shall be used for the duration of the Project.

1.26 OPERATION AND MAINTENANCE MANUALS (hereinafter referred to in this Paragraph, collectively as "Manuals").

A. Except as otherwise specified, four (4) copies of the Manuals shall be provided for each item of equipment, or system provided. Completed manuals shall be submitted to the Engineer no later than 60 days following approval of shop drawings.

B. All elements and components of the equipment or system shall be included in the Manuals.

1. The Manuals shall be customized including but not limited to all options, types, sizes, and configurations, shall be indicated, either as one (1) enclosure within the manuals listing them or by eliminating all incorrect references at each occurrence within a standard type of manual.

2. The Manuals shall contain a bill of materials which shall be a parts list detailing the part manufacturer and his catalog number of each equipment part. The Manuals shall include all necessary instructions for the operation, maintenance, repair, assembly, and disassembly of the equipment or system in accordance with the manufacturer's recommendations including troubleshooting charts and lubrication and maintenance schedules.

3. All drawings, plates, lists, schematics, and the like shall be included in the Manuals.

4. Any malfunction of, or damage to the equipment or system resulting from incomplete or incorrect instructions in the Manuals for the guarantee period specified elsewhere in this specification shall be repaired and/or replaced at no additional cost to the Owner.

5. The Manuals shall include a complete parts list, current parts price list, and recommended spare parts list.

6. Any and all capabilities for specified future modification; alteration or reconfiguration shall be completely indicated and described within the Manual.

7. The manuals shall contain the name, address, business telephone numbers and service telephone numbers for the manufacturer and its local distributor/representative.

8. Each Manual for each item of equipment or system shall be bound separately in a permanent binder.

C. The form entitled "Operation and Maintenance Manual Review checklist" shall be utilized and submitted for each specification section to insure completeness of the manual. The form is attached to the end of this section.

D. The Engineer has the right to reject the Manuals submitted as being unsatisfactory or to require the submittal of additional information. The new Manuals or additional information shall be submitted no later than 30 days following notification by the Engineer.

1.27 MANUFACTURER'S SERVICES

A. Installation and Start-up

1. Make arrangements with each equipment supplier or manufacturer to furnish the services of a factory-trained service engineer who is specifically trained on the type of equipment being furnished for the sole purpose and use of the Owner and Engineer to assist during installation and start-up of all equipment and systems furnished by that supplier or manufacturer.

2. Minimum length of time specified for this service shall be exclusive of travel time and of correction of defects, testing, and training.

3. The manufacturer's engineer will verify, in writing, that the equipment has been installed and serviced so as to be acceptable to the equipment manufacturer in order that it will provide safe and efficient operation as intended by the Engineer and the manufacturer. The Engineer will provide a form entitled "Certification of Proper Equipment Installation" which is to be signed by the manufacturer’s representative and the Contractor’s representative for each piece of equipment.

B. Correction of Defects

1. Nothing specified herein shall provide relief of the responsibility of providing sufficient service to place all equipment or systems into satisfactory operation.

2. All time and materials needed to correct defective equipment shall be provided at no cost to the Owner.

C. Testing

1. Prior to testing, each equipment supplier or manufacturer shall furnish a written certification that the equipment is ready for operation. A copy of this certification shall be furnished to the Engineer.

2. Furnish the labor, tools, equipment, power, and clean water necessary to perform field-testing to determine that the supplied equipment including controls and alarms meets hydraulic, electric, mechanical and performance requirements. All tests shall be performed in the presence of the Engineer.

D. Training

1. Wherever called for in the Specifications, have each equipment supplier or manufacturer furnish the services of a fully qualified field service engineer to provide operator training in the complete operation and maintenance of all equipment furnished by that supplier or manufacturer.

2. The minimum length of time specified for this service shall be exclusive of travel time and shall follow and be exclusive of installation and start-up, correction of defects and testing.

3. Schedule training sessions in conjunction with and as approved by the Engineer. This training will be witnessed and verified by a representative appointed by the Engineer. The Engineer has the right to reject the training by the equipment supplier or manufacturer and to require additional training. The items addressed by the training session shall include, but not be limited to, system description, system operation, system disassembly and reassembly, lubrication, routine maintenance, corrective maintenance, use of operation and maintenance manual, system troubleshooting and ordering of spare parts.

4. The Engineer will provide a form entitled "Verification of Manufacturer's Equipment Training" which is to be signed by all parties at the completion of each training session.

1.28 SPARE PARTS

A. Spare parts for all equipment shall be supplied to the Owner as specified. Spare parts shall be individually protected and packaged in a suitable container for long-term storage with the contents therein properly identified on the outside of the container.

B. The Engineer will provide a form entitled "Spare Parts Inventory" which is to be fully completed and submitted to the Engineer for each piece of equipment requiring spare parts.

1.29 SPECIALTY TOOLS

A. Any specialty tools required for the adjustment, operation and/or maintenance of any equipment included in the Work shall be furnished with the respective equipment.

PART 2 PRODUCTS - Not Applicable.

PART 3 EXECUTION - Not Applicable.

END OF TEXT

SEE FOLLOWING FORMS:

1. Verification of Manufacturer's Equipment Training
2. Operation and Maintenance Manual Review Checklist
3. Spare Parts Inventory
4. Certification of Proper Equipment Installation

VERIFICATION OF
MANUFACTURER'S EQUIPMENT TRAINING

CLIENT: PLYMOUTH, MA	ENGINEER: AECOM
PROJECT: Samoset Street Sewer System Expansion	CONTRACTOR:
Specification Section and Equipment:	
Date of Training:	
Instructor:	
Title:	
Representing:	
Facility Staff in Attendance	
Engineer's Representative	
Contractor's Representative	
____ System Description	____ Corrective Maintenance
____ System Operation	____ Use of Manufacturer's Manual
____ System Disassembly and Reassembly	____ Ordering Spare Parts
____ Lubrication	____ Other
____ Routine Maintenance	
I have performed the training described above and concur with this verification.	
Witnessed by:	Signature Title Date Manufacturer's Instructor

OPERATION AND MAINTENANCE MANUAL
REVIEW CHECKLIST

CLIENT: PLYMOUTH, MA		ENGINEER: AECOM
PROJECT: Samoset Street Sewer System Expansion		CONTRACTOR:
Specification Section and Equipment:		
1.	Correct number of copies of Operation and Maintenance Manual Supplied	
2.	General	
	a. Manual Customized	
	b. Manual contains information on complete system (design, installation, O&M instructions)	
	c. All material contained in manual is legible	
	d. Permanent Binder, Labeled and Indexed	
3.	Contact Information	
	a. Name, address, and telephone number of manufacturer	
	b. Name, address, and telephone number of nearest source of replacement parts and service	
4.	Equipment Information	
	a. Equipment drawings, schematics, plates, and layouts	
	b. Equipment Performance Curves	
	c. Maintenance and Lubrication Schedules	
	d. Trouble Shooting Guide	
	e. Parts List (part manufacturer, catalog number, etc.)	
	f. Current Part Costs	
	g. Recommended Spare Parts	
	h.. Special Tools Required	
Remarks:		

SPARE PARTS INVENTORY

CLIENT: PLYMOUTH, MA	ENGINEER: AECOM
PROJECT: Samoset Street Sewer System Expansion	CONTRACTOR:
Equipment:	
Specification Section:	
AECOM Representative:	

Part Number	Part Description	Contractor	Quantity	Owner	Initial Date	Initial Date

CERTIFICATION OF PROPER EQUIPMENT INSTALLATION

CLIENT: PLYMOUTH, MA	ENGINEER: AECOM
PROJECT: Samoset Street Sewer System Expansion	CONTRACTOR:
Equipment:	
Specification Section:	
Date of Equipment Inspection:	
Manufacturer's Representative:	
Representing:	
Contractor's Representative and Title:	
Equipment Installation	
____ Equipment Mounting / Supports	____ Lubrication
____ Safety (guards and/or signage)	____ Calibration
____ Electrical System	____ Spare Parts
____ Instrumentation and/or Control System	____ Other _____
Corrective Action Required:	
Corrective Action Completed:	
I hereby certify that the above noted equipment is ready for safe and efficient operation.	
Witnessed by: _____ Contractor's Representative Signature Date: _____	Certified by: _____ Manufacturer's Representative Signature Date: _____

SECTION 01090

REFERENCE STANDARDS

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes quality assurance and schedule of references.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT – Not Used

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS – Not Used

1.05 PRODUCT HANDLING – Not Used

1.06 QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids unless otherwise specified in Product Sections.

C. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

1.07 SCHEDULE OF REFERENCES

AA	Aluminum Association 818 Connecticut Avenue, N.W. Washington, DC 20006
AABC	Associated Air Balance Council 1000 Vermont Avenue, N.W. Washington, DC 20005
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W. Washington, DC 20001
ACI	American Concrete Institute Box 19150 Reford Station Detroit, MI 48219
ADC	Air Diffusion Council 230 North Michigan Avenue Chicago, IL 60601
AI	Asphalt Institute Asphalt Institute Building College Park, MD 20740
AISC	American Institute of Steel Construction 400 North Michigan Avenue, Eighth Floor Chicago, IL 60611
AISI	American Iron and Steel Institute 1000 16th Street, N.W. Washington, DC 20036

AITC	American Institute of Timber Construction 333 W. Hampden Avenue Englewood, CO 80110
AMCA	Air Movement and Control Association 30 West University Drive Arlington Heights, IL 60004
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
APA	American Plywood Association Box 11700 Tacoma, WA 98411
ARI	Air-Conditioning and Refrigeration Institute 1501 Wilson Boulevard Arlington, VA 22209
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, N.E. Atlanta, GA 30329
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASPA	American Sod Producers Association 4415 West Harrison Street Hillside, IL 60162
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWI	Architectural Woodwork Institute 2310 South Walter Reed Drive Arlington, VA 22206
AWPA	American Wood-Preservers' Association 7735 Old Georgetown Road Bethesda, MD 20014
AWS	American Welding Society 550 LeJeune Road, N.W. Miami, FL 33135

AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
BIA	Brick Institute of America 11490 Commerce Park Drive Reston, VA 22091
CDA	Copper Development Association 57th Floor, Chrysler Building 405 Lexington Avenue New York, NY 10174
CLFMI	Chain Link Fence Manufacturers Institute 1101 Connecticut Avenue, N.W. Washington, DC 20036
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, IL 60195
DHI	Door and Hardware Institute 7711 Old Springhouse Road McLean, VA 22102
EJCDC	Engineers' Joint Contract Documents Committee American Consulting Engineers Council 1015 15th Street, N.W. Washington, DC 20005
EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591
FGMA	Flat Glass Marketing Association 3310 Harrison White Lakes Professional Building Topeka, KS 66611
FM	Factory Mutual System 1151 Boston-Providence Turnpike P.O. Box 688 Norwood, MA 02062
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407

GA	Gypsum Association 1603 Orrington Avenue Evanston, IL 60201
ICBO	International Conference of Building Officials 5360 S. Workman Mill Road Whittier, CA 90601
IEEE	Institute of Electrical and Electronics Engineers 345 East 47th Street New York, NY 10017
IMIAC	International Masonry Industry All-Weather Council International Masonry Institute 815 15th Street, N.W. Washington, DC 20005
MBMA	Metal Building Manufacturer's Association 1230 Keith Building Cleveland, OH 44115
MFMA	Maple Flooring Manufacturers Association 60 Rivere Drive Northbrook, IL 60062
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
ML/SFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
NCMA	National Concrete Masony Association P.O. Box 781 Herndon, VA 22070
NEBB	National Environmental Balancing Bureau 8224 Old Courthouse Road Vienna, VA 22180
NEMA	National Electrical Manufacturers' Association 2101 'L' Street, N.W. Washington, DC 20037

NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269
NFPA	National Forest Products Association 1619 Massachusetts Avenue, N.W. Washington, DC 20036
NSWMA	National Solid Wastes Management Association 1730 Rhode Island Ave., N.W. Washington, DC 20036
NTMA	National Terrazzo and Mosaic Association 3166 Des Plaines Avenue Des Plaines, IL 60018
NWMA	National Woodwork Manufacturers Association 205 W. Touhy Avenue Park Ridge, IL 60068
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077
PCI	Prestressed Concrete Institute 201 North Wells Street Chicago, IL 60606
PS	Product Standard U. S. Department of Commerce Washington, DC 20203
SDI	Steel Deck Institute P.O. Box 9506 Canton, OH 44711
SDI	Steel Door Institute 712 Lakewood Center North 14600 Detroit Avenue Cleveland, OH 44107
SIGMA	Sealed Insulating Glass Manufacturers Association 111 East Wacker Drive Chicago, IL 60601
SJI	Steel Joist Institute 1205 48th Avenue North, Suite A Myrtle Beach, SC 29577

SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 8224 Old Court House Road Vienna, VA 22180
SSPC	Steel Structures Painting Council 4400 Fifth Avenue Pittsburgh, PA 15213
TCA	Tile Council of America, Inc. Box 326 Princeton, NJ 08540
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062
WWPA	Western Wood Products Association 1500 Yeon Building Portland, OR 97204

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01140

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.01 SCOPE

A. The work covered by this section includes the furnishing of all labor, tools, equipment and materials necessary to perform all work necessary or as may be required to prevent environmental damage and/or pollution to wetland resource areas during and as a result of construction operations under this Contract.

B. All work shall conform to the requirements stated herein and to the requirements of the regulatory agencies having jurisdiction over the areas of work.

C. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

D. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. Comply with all requirements of the Notice of Intent and/or as specified by the Conservation Commission in the Order of Conditions at no additional cost to the Owner.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Grass seed.

2. Siltation fence.

3. Silt Sock.

4. Woven netting.

5. Geotextile material.

6. Erosion control blanket.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 IMPLEMENTATION AND COMPLIANCE

A. Meet with the Conservation Commission, if required, regarding requirements of the execution of, and compliance with the Order of Conditions. Familiarize yourself with the nature of work to be performed and the extent and peculiarities of the wetland resource areas in the project area as shown or described in the Notice of Intent and/or specifications.

B. All work shall be done in compliance with the Notice of Intent or as specified by the Conservation Commission in the Order of Conditions. Failure to comply with these provisions shall constitute grounds for the Conservation Commission ordering work to cease until such provisions are met.

C. Any work conducted in violation of the Order of Conditions shall cease upon receipt of an Enforcement Order issued by the Conservation Commission. Failure to comply with the Order of Conditions may constitute grounds for legal action

D. The requirements specified hereinbefore and in the Order of Conditions, shall be considered as minimum, and may be supplemented, altered or deleted in whole or in part by the appropriate regulatory agencies based on actual site conditions. Control devices may be required outside of the limits of designated buffer zones to protect wetlands and/or water resource areas, if the proposed construction will tend to alter or be detrimental to these areas.

1.06 AREAS OF WORK

A. Confine construction operations to those areas designated or defined by the drawings. Do not occupy adjacent public or private property without the express written approval of the Owner, abutters, or the appropriate regulatory agencies having jurisdiction.

1.07 CLEARING, GRUBBING AND STRIPPING

A. Limit clearing, grubbing and stripping operations to the minimum necessary to facilitate work. Specific limits of work in wetland resource areas may be individually defined within the Notice of Intent, Order of Conditions and/or as specified by the Conservation Commission or their designee.

B. It is the intent under this Contract to minimize the land area which is to be exposed and free from vegetation during construction, therefore schedule your operations accordingly. In areas where topographical and/or drainage conditions require their use, temporary vegetation, hay bale barriers, or other protective devices shall be used to prevent erosion.

C. Install siltation barriers prior to the start of any work in defined wetland resources or their buffer zones. Unless otherwise recommended by the Conservation Commission or their designee, siltation fencing in combination with a hay bale barrier shall be used wherever the drawings require a siltation barrier. In cases were field conditions necessitate, a siltation fence may be used without hay bales, if approved in writing by the Conservation Commission.

1.08 LOCATION AND STORAGE OF MATERIALS

A. No earthen materials shall be dispersed or stockpiled in any wetland resource area unless specifically allowed in the Order of Conditions. No excavated materials, except that which is to be reused for backfilling, shall be deposited within 100 feet of any watercourse, wetlands area or drainage facility without the express written approval of the Conservation Commission.

B. Materials rejected by the Engineer for use in the backfilling operation shall be removed and legally disposed of.

C. Adequate protective measures shall be taken to prevent the erosion of stockpiled material and resultant sedimentation of adjacent watercourses, wetland areas or drainage facilities, during the course of constructing the work.

1.09 PROTECTION OF WATER RESOURCES

A. Do not discharge fuel oil, sewage, septic waste or other deleterious substances into streams, groundwater supplies or wetlands areas. The storage of fuel oil, refueling of equipment and lubrication of equipment shall be restricted to designated areas outside of all wetland resource areas and their buffer zones or areas approved by the Conservation Commission. Report any spillage of deleterious substance (fuel oil, lubricants, septic waste, etc.) to the Owner and appropriate regulatory agency and appropriate measures taken, as determined by the regulatory agency, to contain and to clean up the affected areas.

B. Any water that is pumped or bailed from the excavations shall be conveyed by conduit or hose to points of discharge. Water shall be filtered through sedimentation barriers, constructed in such a manner so as to minimize velocities of discharge and to contain silt. Sedimentation barriers shall be cleaned and/or replaced periodically to ensure effective control and protection of wetlands and water resource areas.

1.10 DUST CONTROL

A. Due to close geographic location of Project to other off-site facilities and residential homes take special care in providing and maintaining temporary site roadways, existing driveways, and public roads used during construction operations in clean, dust free condition.

B. Comply with local environmental regulations for dust control. If Contractor’s dust control measures are considered inadequate by Engineer, Engineer may require Contractor to take additional dust control measures.

C. The control of dust shall be accomplished by the application of clean water. The use of calcium chloride is not allowed. Refer to SECTION 01030, SPECIAL REQUIREMENTS.

PART 2 PRODUCTS

2.01 MATERIALS

A. Grass seed for temporary erosion control shall be Annual Ryegrass, unless otherwise specified by the Conservation Commission.

B. Hay bales for mulching, slope protection, and for use as sedimentation traps in borrow areas and as barriers in drainage swales shall conform to the details shown on the drawings.

C. Siltation fence shall be made of 15 mil reinforced polypropylene (3.5 ounce per square yard). It shall have a water flow rate of 20 gallons per minute per square foot. The apparent opening size shall be 36-50 (U.S. Standard Sieve). Fabric shall be stable against ultraviolet radiation. Fabric width shall be 3 feet with netting and tension cord on 1-1/2 inch by 1-1/2 inch by 48-inch posts. Siltation fence shall be "Envirofence" Style No. 10550 as manufactured by Mirafi Inc., Charlotte N.C., or equal.

D. Silt Sock shall be made of photodegradable materials that once plants have rooted, the fabric will disintegrate and leave a long lasting natural barrier to erosion from water runoff. Silt Socks shall be filled with 100 percent organic compost, or woods chips free of seed and low in moisture content. The mulch shall be composted a period of time greater than 4 months to kill insect larva and eggs. Silt Socks shall be “ETS Silt Tubes” as manufactured by Erosion Technology Services, Berlin, OH, MVK Silt Sock, Rowley, MA, or equal.

E. Woven netting or "jute mesh" shall be "Ludlow Soil Saver", as manufactured by the Ludlow Corp., or similar product as manufactured by Advanced Netting Co., or "Jute-Net" as manufactured by Bemis, Inc.

F. Geotextile material for sedimentation basin shall consist of a woven or non-woven fabric made from polypropylene. The fabric shall be non-rotting, acid- and alkali-resistant and inert to organic chemicals commonly encountered in soils.

G. Erosion control blanket shall be SC150 as manufactured by North American Green or equal.

PART 3 EXECUTION

3.01 FLOOD FLOWS

A. Stream flows and water levels of wetland and water resource areas may vary substantially due to climatic and seasonal conditions. Control and handle ground and/or surface water regardless of the volume of water and regardless of whether this flow is due to floodwaters from storms.

3.02 WATER CONTROL FACILITIES

A. Construct and maintain all necessary channels or other protective works; furnish all materials required therefore; and furnish, install, maintain, and operate all necessary pumping facilities for dewatering the various parts of the work and for bypassing stream flows and for maintaining other parts of the work free from water as required for construction. After having served their purpose, all control facilities and other temporary protective works shall be removed and or leveled so as not to present an unsightly appearance and interfere in any way with the watercourse or resource areas.

B. No direct discharge into any wetland and/or water resource will be allowed. Where required, discharge water shall be piped to a sedimentation basin. Such installations shall ensure the inviolability of all natural waterways or other wetland resource areas and shall not cause excessive siltation or negative impacts on wetlands or water resource areas.

C. Upon completion of work, trapped sediment shall be removed from the sedimentation basins and shall be legally disposed of. Sedimentation basins shall then be dismantled and legally removed from the construction site. The area previously covered by the basin shall be regraded and revegetated.

3.03 EROSION AND TURBIDITY CONTROL

A. Take every precaution to minimize and control erosion and turbidity within the project area. These precautions shall be subject to approval by the Conservation Commission and shall include, but not necessarily be limited to, the following:

1. Stockpiles of excavated materials in buffer zones as well as exposed cut and fill slopes shall be kept to minimum gradients whenever possible. During the contract period, these areas shall be protected with hay, mulch, netting, grass seed or combination of the above to slow down the rate of surface run-off and to reduce the volume of suspended solids in the run off water.

2. Siltation barriers shall be staked in place down gradient from all exposed borrow areas or material storage areas in order to reduce the amount of suspended solids in runoff water. The exact location of the siltation barriers may vary from that shown on the drawings or in the Notice of Intent and may require adjustment in the field as work progresses. Promptly remove any sedimentation buildup over six inches in depth that accumulates behind the siltation barriers. Barriers shall be checked after every storm and at regular weekly intervals.

3. Siltation barrier shall be installed with wooden stakes in accordance with manufacturer directions. Bottom 6 inches of fabric shall be toed in or backfilled so that top of fabric shall be 2 feet 6 inches above finish grade.

3.04 BUFFER ZONES

A. Protective measures shall be used around catch basins (e.g., filter fabric surrounded by haybales). After project completion, accrued silt shall be removed from the roadway and legally disposed of and catch basin sumps shall be cleaned.

B. Erosion control barriers adjacent to wetland resources as delineated on the drawings shall be used as previously specified herein.

C. Any water that is pumped or bailed from excavations shall be discharged to the ground without the direct unfiltered reentry to a wetland resource area. If this is not possible, dewatering fluids shall be filtered through sedimentation basins constructed in such a manner so as to minimize velocities and to minimize the silt content of discharge to streams or other wetland resource areas. Discharges from sedimentation basins to a wetland resource area shall have sheet flow.

END OF SECTION

SECTION 01310

MISCELLANEOUS TESTING AND SOIL DATA

PART 1 GENERAL

1.01 SCOPE

A. The Work of this section includes the furnishing of all labor, materials, tools and equipment required to perform miscellaneous testing as required in the Contract Documents and/or as directed by the Engineer.

B. Existing testing and subsurface soil data, if available, is included in this section.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. In addition to the above, measurement and payment shall be in accordance to the following:

1. Payment for testing shall be as specified under the applicable Payment Items included under SECTION 01025, MEASUREMENT AND PAYMENT.

2. Pay all up front costs associated with additional testing. If the testing proves the Work is defective or materials are unsatisfactory then correct all defective Work at no cost to the Owner. If the testing proves the Work and/or materials are satisfactory, then the Owner will pay for costs associated with additional testing.

3. Where the technical section of the Specifications required that a piece of equipment be tested at the manufacturer's facility or at the site, the cost of such tests shall be included in the price of the equipment.

1.03 DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals shall include shop drawings including at least the following:

1. Additional Testing.

1.05 PRODUCT HANDLING – Not Used

1.06 DESIGN CRITERIA

A. Subsurface soil data is for general information only. The information pertains to the subsoil conditions in the vicinity of the Work, and is given to assist in properly evaluating the amount and character of the Work required hereunder. Such data is represented as being the best factual information available.

1. The Owner and Engineer assume no responsibility for the accuracy thereof or for any conclusions that might draw therefrom.

2. It is understood and agreed that, by careful examination, you have satisfied yourself as to the nature and location of the Work, have examined such logs of test borings and/or records made of underground exploration as may be available, understand the character of equipment and facilities needed for the prosecution of the Work, the general and local conditions, and all other matters which could in any way affect the Work under this Contract.

3. Jar samples, if available, may be examined during normal business hours, at the Owner’s office.

PART 2 PRODUCTS - Not Applicable

PART 3 EXECUTION - Not Applicable

END OF TEXT

SEE ATTACHED SUBSURFACE DATA

SUBSURFACE DATA

Aldrin Street
Armstrong Rd
Route 44
Samoset St
Pilgrim Hill Rd
Summer St
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
B-9
B-10
B-11
B-12
B-13
B-14
B-15
B-16
B-17
B-18
(MW-1)
B-19
B-20
B-21
B-22
B-23
B-24
B-25
B-26
B-27
B-27A
B-31
Proposed Pumping
Station Site
Town of Plymouth, MA
Samoset Street Sewer
System Expansion
Legend
Proposed Boring Location
0 200 400 800 Feet
N

AECOM

Client Name	New Hampshire Boring, Inc. 1215 W. Chestnut Street Brockton, MA 02301	Sheet 1 of 1	**Boring No.** B-1
AECOM		NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/14/2014 8:00AM	1/14/2014 8:00AM	1.75
DRILLER: Jason Stokes	HELPER: Robert Brennan		
Ground Elevation: 133.6'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	31	62	38	35	16"	Dry, very dense, brown/white FINE TO MEDIUM SAND and fine to medium gravel.	
S-2	4' - 6'	10	15	13	13	14"	Dry, very dense, brown/white FINE TO MEDIUM SAND and fine to medium gravel.	
S-3	7' - 9'	18	15	11	19	15"	Dry, medium dense, brown, FINE SAND, trace fine gravel.	9'
							Bottom of Exploration = 9'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE:

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-2
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/14/2014 9:15AM	1/14/2014 10:30AM	1.25
DRILLER: Jason Stokes	HELPER: Robert Brennan		
Ground Elevation: 135.8'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	14	26	29	22	15"	Dry, very dense, brown, FINE TO MEDIUM SAND, some fine gravel.	
S-2	5' - 7'	9	15	33	75	9"	Dry, dense, tan-brown, FINE SAND, trace medium sand, trace fine gravel.	
S-3	10' - 12'	10	10	13	11	6"	Dry, medium dense, brown, FINE SAND, trace fine gravel.	
S-4	15' - 17'	10	18	19	21	10"	Dry, medium dense, brown, FINE SAND, trace fine gravel.	17'
							Bottom of Exploration = 17'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE:

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-3
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	

City/Town: Plymouth, MA — PROJECT NAME: Route 44 Borings

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/14/2014 9:15AM	1/14/2014 10:45AM	1.5
DRILLER: Jason Stokes	HELPER: Robert Brennan		

Ground Elevation: 130.8' — Inspector's Name (Print): Dan — Inspector's Company: AECOM

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	29	48	38	36	17	Dry, very dense, brown, FINE TO MEDIUM SAND, trace fine to medium gravel.	
S-2	5' - 7'	8	10	8	8	9	Dry, medium dense, brown, FINE TO MEDIUM SAND, trace fine gravel.	
S-3	9' - 11'	6	8	9	13	12	Dry, medium dense, brown, FINE SAND.	
S-4	11'- 13'	6	5	12	17	15	Dry, medium dense, brown, FINE SAND.	13'
							Bottom of Exploration = 13'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE:

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-4
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/14/2014 10:45AM	1/14/2014 12:15PM	1.5
DRILLER: Jason Stokes	HELPER: Robert Brennan		
Ground Elevation: 128'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	44	42	36	31	15"	Dry, very dense, dark gray, FINE TO MEDIUM SAND, trace fine gravel.	
S-2	5' - 7'	22	31	18	15	14"	Dry, medium dense, brown, FINE, trace fine gravel.	
S-3	9' - 11'	2	3	3	4	11"	Dry, loose, brown/orange, FINE SAND.	11'
							Bottom of Exploration = 11'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE:

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-5
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/14/2014 12:30pm	1/14/2014 2:30PM	2
DRILLER: Jason Stokes	HELPER: Robert Brennan		
Ground Elevation: 132.2'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	18	15	14	11	9"	Dry, medium dense, brown, FINE TO MEDIUM SAND, trace fine gravel.	
S-2	5' - 7'	4	4	5	6	13"	Dry, loose, tan, FINE TO MEDIUM SAND.	
S-3	10' - 12'	9	8	10	12	17"	Dry, medium dense, tan, FINE SAND.	
S-4	14' - 16'	15	38	30	54	15"	Dry, very dense, brown, FINE TO MEDIUM SASD, trace	
S-4	16' - 18'	38	72	38	31	14"	Dry, medium dense, brown, FINE TO MEIDUM SAND, some fine to medium gravel.	18'
							Bottom of Exploration = 18'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE:

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-6
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/15/2014 8:00AM	1/15/2014 9:30AM	1.5
DRILLER: Jason Stokes	HELPER: Robert Brennan		
Ground Elevation: 123.2'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	18	21	19	21	13"	Dry, dense, brown, FINE SAND, some inorganic silt, some fine gravel.	
S-2	5' - 7'	3	4	4	6	19"	Dry, loose, tan, FINE SAND.	
S-3	9' - 11'	4	4	5	6	15"	Dry, loose, tan, FINE SAND.	11'
							Bottom of Exploration = 11'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE:

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-7
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/15/2014 9:30AM	1/15/2014 10:30AM	1
DRILLER: Jason Stokes	HELPER: Robert Brennan		
Ground Elevation: 122.8'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	31	21	17	19	14"	Dry, dense, dark brown/black, FINE TO MEDIUM SAND, some fine gravel.	
S-2	5' - 7'	9	10	29	14	15"	Dry, dense, brown/black, FINE TO MEDIUM SAND, trace inorganic silt, trace fine gravel.	
S-3	9' - 11'	9	10	6	5	11"	Dry, medium dense, tan, FINE SAND.	11'
							Bottom of Exploration = 11'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE:

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-8
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/15/2014 10:30AM	1/15/2014 11:30AM	1
DRILLER: Jason Stokes	HELPER: Nicholas Mullins		
Ground Elevation: 129.4'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	18	35	42	21	15"	Dry, very dense, gray, FINE SAND, trace inorganic silt, trace fine gravel.	
S-2	5' - 7'	9	11	13	11	9"	Dry, medium dense, brown, FINE TO COARSE SAND, trace fine gravel.	
S-3	10' - 12'	9	10	13	9	15"	Dry, medium dense, tan, FINE TO MEDIUM SAND, trace fine gravel.	12'
							Bottom of Exploration = 12'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: CME 75

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-9
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/15/2014 11:00AM	1/15/2014 12:30pm	1
DRILLER: Jason Stokes	HELPER: Nicholas Mullins		
Ground Elevation: 149.2'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	31	46	61	25	16"	Dry, very dense, tan/brown, FNE TO MEDIUM SAND, trace fine gravel.	
S-2	5' - 7'	2	2	3	2	15"	Dry, loose, brown, FINE TO MEDIUM SAND.	
S-3	8' - 10'	4	5	4	4	13"	Dry, loose, tan, FINE TO MEDIUM SAND.	13'
							Bottom of Exploration = 13'	

Remarks:

AUGER SIZE: 2.3

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: CME 75

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-10
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Pilgrim Hill Road/Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/15/2014 12:30pm	1/15/2014 1:30pm	1
DRILLER: Jason Stokes	HELPER: Nicholas Mullins		
Ground Elevation: 157.6'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	33	24	31	38	15"	Dry, very dense, brown, FINE SAND, trace fine gravel.	
S-2	5' - 7'	7	10	9	8	6"	Dry, medium dense, brown, FINE TO MEDIUM SAND.	
S-3	10' - 12'	5	6	5	5	9"	Dry, medium dense, brown, FINE SAND.	12'
							Bottom of Exploration = 12'	

Remarks:

AUGER SIZE: 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: CME 75

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-11
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/15/2014 1:30PM	1/15/2014 2:30PM	1
DRILLER: Jason Stokes	HELPER: Nicholas Mullins		
Ground Elevation: 170'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	26	41	37	43	15"	Dry, very dense, gray, FINE TO COARSE SAND, trace fine gravel.	
S-2	5' - 7'	15	28	31	15	17"	Dry, very dense, brown, FINE TO COARSE SAND, trace fine gravel.	
S-3	10' - 12'	5	6	5	7	8"	Dry, medium dense brown, FINE TO MEDIUM SAND.	12'
							Bottom of Exploration = 12'	

Remarks:

AUGER SIZE: 2.3

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: CME 75

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-12
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/15/2014 9:30AM	1/15/2014 10:30AM	1
DRILLER: Jason Stokes	HELPER: Robert Brennan		
Ground Elevation: 134.2'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	31	63	48	35	17"	Dry, very dense, brown, FINE TO MEDIUM SAND, trace fine gravel.	
S-2	5' - 7'	15	21	35	42	16"	dry, dense, brrown/tan, FINE SAND, trace fine gravel.	
S-3	9' - 11'	4	4	5	6	14"	Dry, loose, brwn, FINE SAND.	11'
							Bottom of Exploration = 11'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: CME-75

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-13
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Pilgrim Hill Road/Somoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/13/2014 9:30am	1/13/2014 11:30am	1.25
DRILLER: Jason Stokes	HELPER: Robert Brennan		
Ground Elevation: 138.6'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT	6"
S-1	6" - 2'6"	15	23	28	29	16"	Dry, very dense, brown, FINE TO MEIDUM SAND, trace fine gravel.	
S-2	5' - 7'	25	24	19	23	14"	Dry, dense, brwn, FINE TO MEIDUM SAND, trace fine gravel.	
S-3	9' - 11'	19	8	7	11	9"	Dry, medium dense,tan/brown, FINE TO MEDIUM SAND.	11'
							Bottom of Exploration = 11'	

Remarks:

AUGER SIZE: 2.25" - 4.25"

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: CME-75

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 3	**Boring No.** B-14
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Pilgrim Hill Road and Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Ground water; None Encountered	1/20/2014	1/20/2014	
DRILLER: Jason Stokes	HELPER: Robert Brennan		
Ground Elevation: 144.4'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
							ASPHALT AND GRAVEL	
S-1	6" - 2'6"	12	39	43	29	15"	Dry, very dense, brown, FINE SAND, trace fine gravel.	
S-2	5' - 7'	18	19	23	29	13"	Dry, dense, brown, FINE SAND.	
S-3	9' - 11'	22	24	20	14	18"	Dry, dense, brown, FINE TO MEDIUM SAND, trace fine gravel.	11'
							Bottom of Exploration = 11'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-15
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Pilgrim Hill Road	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/13/2014 11:30AM	1/13/2014 1:00PM	1.25
DRILLER: Jason Stokes	HELPER: Robert Brennan		
Ground Elevation: 160.8'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	27	38	48	41	18"	Dry, very dense, brwn, FINE TO MEDIUM SAND, trace fine gravel.	
S-2	5' - 7'	14	13	24	19	16"	Dry, dense, brwon, FINE TO MEIDUM SAND, trace fine gravel.	
S-3	9' - 11'	10	10	11	14	17"	Dry, medium dense, brown, FINE TO MEDIUM SAND, trace fine gravel.	11'
							Bottom of Exploration = 11'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: CME-75

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-16
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Pilgrim Hill Road	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/13/2014 1:15PM	1/13/2014 2:30PM	1.25
DRILLER: Jason Stokes	HELPER: Robert Brennan		
Ground Elevation: 167.6'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	19	38	43	41	17"	Dry, very dense, brown, FINE TO MEDIUM SAND, trace fine gravel.	
S-2	5' - 7'	13	14	17	17	15"	Dry, very dense, brown, FINE TO MEDIUM SAND, trace fine gravel.	
S-3	9' - 11'	11	13	12	28	16"	Dry, medium dense, brown, FINE TO MEDIUM SAND, trace fine gravel.	11'
							Bottom of Exploration = 11'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: CME-75

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 3	**Boring No.** B-17
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA	Pump Station	PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 29'5"	1/20/2014	1/20/2014	
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 113'	Inspector's Name (Print):	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-1	0' - 2'	1	1	1	2	14"	Dry, very loose, dark brown to tan, COARSE TO FINE SAND, trace inorganic silt.	
S-2	3' - 5'	3	3	2	2	20"	Moist, loose, tan FINE TO MEDIUM SAND.	
S-3	8' - 10'	4	3	3	4	24"	Moist, loose, tan, FINE TO MEDIUM SAND.	
S-4	14' - 16'	6	8	12	12	12"	Moist, medium dense, tan, FINE SAND.	
S-5	19' - 21'	7	10	13	14	12"	Moist, medium dense, FINE SAND, some medium sand.	
S-6	24' - 26'	10	11	13	15	14"	Wet, medium dense, tan, FINE TO MEDIUM SAND, some coarse sand.	

Remarks:

Casing: HW

CASING SIZE: 4"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 2 of 3	**Boring No.** B-17
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA	Pump Station	PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 29'5"	1/20/2014	1/20/2014	
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 113'	Inspector's Name (Print):	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-7	29' - 31'	9	8	9	8	14"	Wet, medium dense, tan, FINE TO MEDIUM SAND, some coarse sand.	
S-8	34' - 36'	7	9	9	11	7"	Wet, medium dense, tan, FINE SAND, some medium sand.	
S-9	39' - 41'	7	7	9	8	10"	Wet, medium dnese, tan, FINE SAND.	
S-10	44' - 46'	5	6	8	10	10"	Wet, medium dense, tan, COARSE TO MEDIUM SASD, trace fine san dand inorganic silt.	
S-11	49' - 51'	6	6	8	8	9"	Wet, medium dense, tan, COARSE SAND, some fine sand, trace inorganic silt.	

Remarks:

Casng: HW

CASING SIZE: 4"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 3 of 3	**Boring No.** B-17
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA	Pump Station	PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 29'	1/20/2014	1/20/2014	
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 113'	Inspector's Name (Print):	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-12	54' - 56'	6	6	7	8	3"	Wet, medium dense, tan, COARSE SASD, some fine sand, trace inorganic silt.	
S-13	59' - 61'4"	10	13	50/4"		15"	Wet, very dense, tan, COARSE TO MEDIUM SAND, trace fine sand and inorganic silt.	61'4"
							Bottom of Exploration = 61'4"	

Remarks:

Casing: HW

CASING SIZE: 4"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 3	**Boring No.** B-18
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA	Pump Station	PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 27'	1/20/2014	1/20/2014	
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 113'	Inspector's Name (Print):	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-1	0' - 2'	2	1	1	2	18"	Dry, very loose, dark tan/brown, FINE TO MEDIUM SAND, trace inorganic silt.	
S-2	4' - 6'	2	3	3	2	24"	Moist, loose, light tan, MEDIUM TO FINE SAND.	
S-3	9' - 11'	2	3	3	4	23"	Moist, loose, light tan, MEDIUM TO FINE SAND.	
S-4	14' - 16'	6	7	10	15	11"	Moist, medium dense, tan, FINE TO MEDIUM SAND.	
S-5	19' - 21'	7	11	11	11	13"	Moist, medium dense, tan, FINE TO MEDIUM SAND.	
S-6	24' - 26'	10	12	15	18	12"	Wet, medium dense, tan, FINE TO MEDIUM SAND.	

Remarks: Installed 2" monitoring well at 40', 20' screen, stand pipe, sand and bentonite.

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Monitoring Well at 40'

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 2 of 3	**Boring No.** B-18
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 29'5"	1/20/2014	1/20/2014	
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 113'	Inspector's Name (Print):	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-7	29' - 31'	7	6	7	10	11"	Wet, medium dense, tan, FINE TO MEDIUM SAND.	
S-8	34' - 36'	7	10	11	11	12"	Wet, medium dense, tan, FINE TO MEDIUM SAND.	
S-9	39' - 41'	10	9	9	10	16"	Wet, medium dense, tan, FINE TO MEDIUM SAND.	
S-10	44' - 46'	7	8	9	12	17"	Wet, medium dense, tan, FINE SAND.	
S-11	49' - 51'	9	9	10	15	19"	Wet, medium dense, tan, FINE SAD, trace inorganic silt.	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 3 of 3	**Boring No.** B-18
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 29'5"	1/20/2014	1/20/2014	
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 113'	Inspector's Name (Print):	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-12	54' - 56'	7	8	10	13	13"	Wet, medium dense, tan, FINE TO MEDIUM SAND, trace inorgani silt.	
S-13	59' - 61'	5	9	10	9	2"	Wet, medium dense, tan, COARSE SAND, some fine sasd.	61'
							Bottom of Exploration = 61'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 3	**Boring No.** B-19
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA	Pump Station	PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 29'	1/20/2014	1/20/2014	
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 113'	Inspector's Name (Print):	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-1	0' - 2'	2	3	2	3	11"	Dry, loose, brown, TOPSOIL, coarse to fine, trace inorganic silt.	
S-2	4' - 6'	2	1	2	2	24"	Moist, very loose, FINE SAND.	
S-3	9' - 11'	4	4	5	7	20"	Dry, loose, tan, FINE TO MEDIUM SAND.	
S-4	14' - 16'	7	8	8	10	8"	Wet, medium dense, tan, COARSE TO FINE SAND.	
S-5	19' - 21'	9	12	14	12	10"	Wet, medium dense, tan, COARSE TO MEDIUM SAND, trace fine sand.	
S-6	24' - 26'	10	11	11	15	11"	Moist, medium dense, tan, FIEN TO COARSE SAND.	

Remarks:
bentonite.

Casing: HW

CASING SIZE: 4"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 2 of 3	**Boring No.** B-19
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 29'5"	1/20/2014	1/20/2014	
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 113'	Inspector's Name (Print):	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-7	29' - 31'	6	6	7	7	10"	Wet, medium dense, tan, FINE SAND, trace mdium sand.	
S-8	34' - 36'	6	8	8	8	6"	Wet, medium dense, tan , FINE SAND, some inorganic silt, trace medium sand.	
S-9	39' - 41'	8	8	7	6	4"	Wet, medium dense, tan, FINE TO COARSE SAND, some gravel.	
S-10	44' - 46'	6	6	6	5	8"	Wet, medium dense, tan, COARSE TO FINE SAND, trace inorganic silt.	
S-11	49' - 51'	7	9	9	11	12"	Wet, medium dense, tan, FINE TO MEDIUM SAND, trace inorganic silt.	

Remarks:

Casing: HW

CASING SIZE: 4"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 3 of 3	**Boring No.** B-19
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 29'5"	1/20/2014	1/20/2014	
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 113'	Inspector's Name (Print):	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-11	54' - 56'	5	4	5	6	7"	Wet, loose, tan, COARSE TO MEDIUM SAND, some fine sand.	
S-12	59' - 61'	10	12	12	10	10"	Wet, medium dense, tan, FINE SAND, trace inorganic silt, trace medium sand.	61'
							Bottom of Exploration = 61'	

Remarks:

Casing: HW

CASING SIZE: 4"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 3	**Boring No.** B-20
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA	Pump Station	PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 29'	1/20/2014	1/20/2014	
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 111.5'	Inspector's Name (Print):	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-1	0' - 2'	1	1	1	2	16"	Dry, very loose, brown, FINE TO COARSE SAND and inorganic silt.	
S-2	4' - 6'	3	2	3	4	21"	Dry, loose, tan, FINE SAND.	
S-3	9' - 11'	3	3	3	4	22"	Dry, loose, tan, FINE SAND.	
S-4	14' - 16'	6	9	12	12	11"	Moist, medium dense, tan, FINE SAND.	
S-5	19' - 21'	9	12	14	12	10"	Moist, medium dense, tan, COARSE TO FINE SAND.	
S-6	24' - 26'	10	12	15	18	11"	Moist, medium dense, tan, FINE SAND, trace fine gravel.	

Remarks:
bentonite.

Casing: HW

CASING SIZE: 4"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 2 of 3	**Boring No.** B-20
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA	Pump Station	PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 29'5"	1/20/2014	1/20/2014	
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 111.5'	Inspector's Name (Print):	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-7	29' - 31'	10	12	14	15	8"	Wet, medium dense, tan, FINE TO COARSE SAND.	
S-8	34' - 36'	7	7	10	12	9"	Wet, medium dense, tan, FINE TO COARSE SAND.	
S-9	39' - 41'	8	9	12	11	13"	Wet, medium dense, tan, MEDIUM TO FINE SAND.	
S-10	44' - 46'	8	11	13	12	14"	Wet, medium dense, tan, FINE SAND, trace inorganic silt.	

Remarks:

Casing: HW

CASING SIZE: 4"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 3 of 3	**Boring No.** B-20
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA	Pump Station	PROJECT NAME: Route 44 Borings	

Location: Samoset Street	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): 29'5"	1/20/2014	1/20/2014	
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 111.5'	Inspector's Name (Print):	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-11	54' - 56'	8	5	4	4	12"	Wet, loose, tan, COARSE SAND, some medium sand, trace fine gravel.	
S-12	59' - 61'	8	7	7	9	10"	Wet, medium dense, tan, COARSE TO FINE SAND.	61'
							Bottom of Exploration = 61'	

Remarks:

Casing: HW

CASING SIZE: 4"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-21
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: X-Country (Wallgreens)	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/22/2014	1/22/2014	1
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 116.8'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	1	2	4	6	12"	Dry, loose, brown, ORGANIC TOPSOIL.	
S-2	5' - 7'	10	9	10	12	18"	Dry, medium dense, brown, FINE TO COARSE SAND.	
S-3	10' - 12'	3	2	2	2	16"	Dry, loose brown, FINE TO COARSE SAND.	12'
							Bottom of Exploration - 12'	

Remarks:

AUGER SIZE: 2.25"

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: CME-75

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 3	**Boring No.** B-22
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: X Country Algonquin Heights	Date & Time Started	Date & Time Completed	Total Hours Worked
Ground water; None Encountered	1/22/2014	1/22/2014	
DRILLER: Brad Enos	HELPER: John Dupris		
Ground Elevation: 130.8'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-1	6" - 2'6"	1	4	3	4	11"	Dry, loose, brown, ORGANIC TOPSOIL	
S-2	5' - 7'	4	7	7	5	12"	Dry, medium dense, brown, FINE TO COARSE SAND, trace fine gravel.	
S-3	10' - 12'	4	5	5	7	15"	Dry, medium dense, brown, FINE TO COARSE SAND, trace fine gravel.	12'
							Bottom of Exploration = 12'	

Remarks:

AUGER SIZE: 4.25 / 2.25

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: B-53

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-23
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: X-Country (Wallgreens)	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/22/2014	1/22/2014	1
DRILLER: Brad Enos	HELPER: John Dube		
Ground Elevation: 113.8'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	1	1	1	2	13"	Dry, very loose, ORGANICS (tosoil)	
S-2	5' - 7'	2	3	3	7	9"	Dry, loose, bronw, FINE TO COARSE SAND.	
S-3	10' - 12'	5	5	6	7	16"	Dry, medium dense, FINE TO COARSE SAND, trace inorganic silt.	12'
							Bottom of Exploration - 12'	

Remarks:

AUGER SIZE: 2.25"

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: CME-75

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New England Boring Contractors	Sheet 1 of 1	Boring No. B-24
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: **28401**	
City/Town: Plymouth, MA		PROJECT NAME: **Sewer Line**	

Location: ROUTE 44	**Date & Time Started**	**Date & Time Completed**	Total Hours Worked
Groundwater Depth (Feet):	11/6/2014	11/6/2014	
DRILLER: Orrin Cone	HELPER: Michael St. John		
Ground Elevation:	**Inspector's Name (Print):** John Finnegan	**Inspector's Company:** PBA Associates	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-1	0-2'	4	16	32	24	5	2" Topsoil.	
							Dry, dense, brown, FINE TO MEDIUM SAND, little gravel	
S-2	2'-4'	4	7	5	7	12	Dry, dark brown, dense, FINE TO MEDIUM SAND, some fine	
							gravel, trace silt.	
S-3	5'-7'	7	3	5	5	12	Dry, black, fine to medium SAND, trace organics, trace silt.	
S-4	7'-9'	3	8	5	5	8	Dry, dark brown, loose, fine to medium SAND, little silt, trace	
							wood.	
S-5	10'-12'	3	5	6	6	18	Dry Brown, loose, fine to medium SAND, little gravel, some silt	
							BOE 12'	
							No Water Encountered	

Remarks:

AUGERS: Hollow Stem Augers

AUGER SIZE 2.25"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: D-50 ATV

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New England Boring Contractors	Sheet 1 of 1	Boring No. B-25
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: **28401**	
City/Town: Plymouth, MA		PROJECT NAME: **Sewer Line**	

Location: ROUTE 44	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet):	11/6/2014	11/6/2014	
DRILLER: Orrin Cone	HELPER: Michael St. John		
Ground Elevation:	**Inspector's Name (Print):** John Finnegan	**Inspector's Company:** PBA Associates	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-1	0-2'	1	5	5	8	5	Dry Brown, loose, FINE TO MEDIUM SAND (Topsoil)	
S-2	2'-4'	7	8	8	10	10	Dry, Brown, loose, FINE TO MEDIUM SAND, some dine to coarse gravel.,	
S-3	5'-7'	6	5	4	3	8	Dry, Brown, loose, FINE TO MEDIUM SAND, some fine gravel, some silt.	
S-4	7'-9'	6	7	7	8	10	Dry, brown, loose, FINE SILTY SAND.	
S-5	10'-12'	16	22	18	20	18	Dry, brown, dense, FINE TO MEDIUM SAND, little Gravel, trace silt.	
							BOE 12'	
							No Water Encountered	

Remarks:

AUGERS: Hollow Stem Augers

AUGER SIZE 2.25"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: D-50 ATV

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New England Boring Contractors	Sheet 1 of 1	Boring No. B-26
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: **28401**	
City/Town: Plymouth, MA		PROJECT NAME: **Sewer Line**	

Location: ROUTE 44	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet):	11/6/2014	11/6/2014	
DRILLER: Orrin Cone	HELPER: Michael St. John		
Ground Elevation:	**Inspector's Name (Print):** John Finnegan	**Inspector's Company:** PBA Associates	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-1	0-2'	4	8	8	5	6	Dry dark, gray loose, FINE TO MEDIUM SAND, some gravel	
S-2	2'-4'	3	4	6	7	5	Dry dark, gray loose, FINE TO MEDIUM SAND, some gravel	
S-3	5'-7'	7	12	10	9	12	Dry, red, medium dense, FINE TO MEDIUM SAND, little gravel	
S-4	7'-9'	7	8	8	8	14	Dry, brown, medium dense, FINE TO MEIDUM SAND, little gravel	
S-5	10'-12'	17	25	25	30	14	Dry, tan, very dense, VERY FINE SAND, little silt.	
							BOE 12'	
							No Water Encountered	

Remarks:

AUGERS: Hollow Stem Augers

AUGER SIZE 2.25"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: D-50 ATV

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New England Boring Contractors	Sheet 1 of 1	Boring No. B-27
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: **28401**	
City/Town: Plymouth, MA		PROJECT NAME: **Sewer Line**	

Location: ROUTE 44	**Date & Time Started**	**Date & Time Completed**	Total Hours Worked
Groundwater Depth (Feet): 10' 4"	11/6/2014	11/6/2014	
DRILLER: Orrin Cone	HELPER: Michael St. John		
Ground Elevation:	**Inspector's Name (Print):** John Finnegan	**Inspector's Company:** PBA Associates	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-1	0-2'	6	14	16	19	9	Dry, dense, brown, FINE SAND, trace fine gravel, trace Silt	
S-2	2'-4'	15	16	9	12	20	Dry, medium dense, brown, FINE SAND, trace fine, gravel, trace silt.	
S-3	5'-7'	7	8	8	14	18	Dry, medium dense, brown, FINE SAND, trace fine, gravel, trace silt	
S-4	7'-9'	14	12	13	13	20	Dry, medium dense, brown, FINE SAND, trace fine, gravel, trace silt.	
S-5	10'-12'	7	10	10	16	18	Wet, medium dense, brown, FINE SAND, trace fine, gravel, trace silt.	
							BOE 12'	
							Water Encountered at 10'4"	

Remarks:

AUGERS: Hollow Stem Augers

AUGER SIZE 2.25"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: D-50 ATV

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New England Boring Contractors	Sheet 1 of 1	Boring No. B-27A
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: **28401**	
City/Town: Plymouth, MA		PROJECT NAME: **Sewer Line**	

Location: ROUTE 44	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet):	11/6/2014	11/6/2014	
DRILLER: Orrin Cone	HELPER: Michael St. John		
Ground Elevation:	**Inspector's Name (Print):** John Finnegan	**Inspector's Company:** PBA Associates	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
S-1	0-2'	2	3	3	4	18	Dry, brown, loose, FINE TO MEDIUM SAND.	
S-2	2'-4'	8	7	7	8	6	Dry, brown, loose, FINE TO MEDIUM SAND.	
S-3	5'-7'	11	14	29	35	8	Dry, tan, dense, FINE TO MEDIUM SAND, little fine gravel, trace silt.	
S-4	7'-9'	10	12	14	16	5	Dry, tan medium dense, FINE TO MEDIUM SAND, little fine gravel, trace silt.	
S-5	10'-12'	36	31	33	38	10	Dry, tan, dense, FINE TO MEDIUM SAND, little fine gravel, trace silt.	
							BOE 12'	
							No Water Encountered	

Remarks:

AUGERS: Hollow Stem Augers

AUGER SIZE 2.25"

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: D-50 ATV

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client Name	New Hampshire Boring, Inc.	Sheet 1 of 1	**Boring No.** B-31
AECOM	1215 W. Chestnut Street Brockton, MA 02301	NHB JOB NUMBER: 28401	
City/Town: Plymouth, MA		PROJECT NAME: Route 44 Borings	

Location: Aldrin Road	Date & Time Started	Date & Time Completed	Total Hours Worked
Groundwater Depth (Feet): None Encountered	1/7/2014 1:00pm	1/7/2014 2:00pm	1
DRILLER: Jason Stokes	HELPER: Robert Brennan		
Ground Elevation: 135.6'	Inspector's Name (Print): Dan	Inspector's Company: AECOM	

Sample Number	Depth Range (Feet)	Blow Counts per 6 Inches 0-6	6-12	12-18	18-24	Recovery (inches)	Field Description	Strata Changes
	0' - 6"						ASPHALT AND GRAVEL	6"
S-1	6" - 2'6"	11	12	21	22	14"	Dry, very loose, ORGANICS (tosoil)	
S-2	5' - 7'	9	10	9	10	15"	Dry, medium dense, tan/brown, FINE TO MEDIUM SAND.	
S-3	8' - 10'	16	9	12	14	15	Dry, medium dense, tan, FINE TO MEDIUM SAND.	10'
							Bottom of Exploration - 10'	

Remarks:

AUGER SIZE: 2.25"

CASING SIZE:

SPLIT SPOON SIZE: 2"

DRILL RIG TYPE: CME-75

Penetration Resistance (N) Guide

Cohesionless Soils (Sands, Gravels)		Cohesive Soils (Silts, Clays)	
Relative Density	Penetration Resistance	Consistency	Penetration Resistance
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Medium Dense	10 - 30	Medium Stiff	4 - 8
Dense	30 - 50	Stiff	8 - 15
Very Dense	Over 50	Very Stiff	15 - 30
		Hard	Over 30

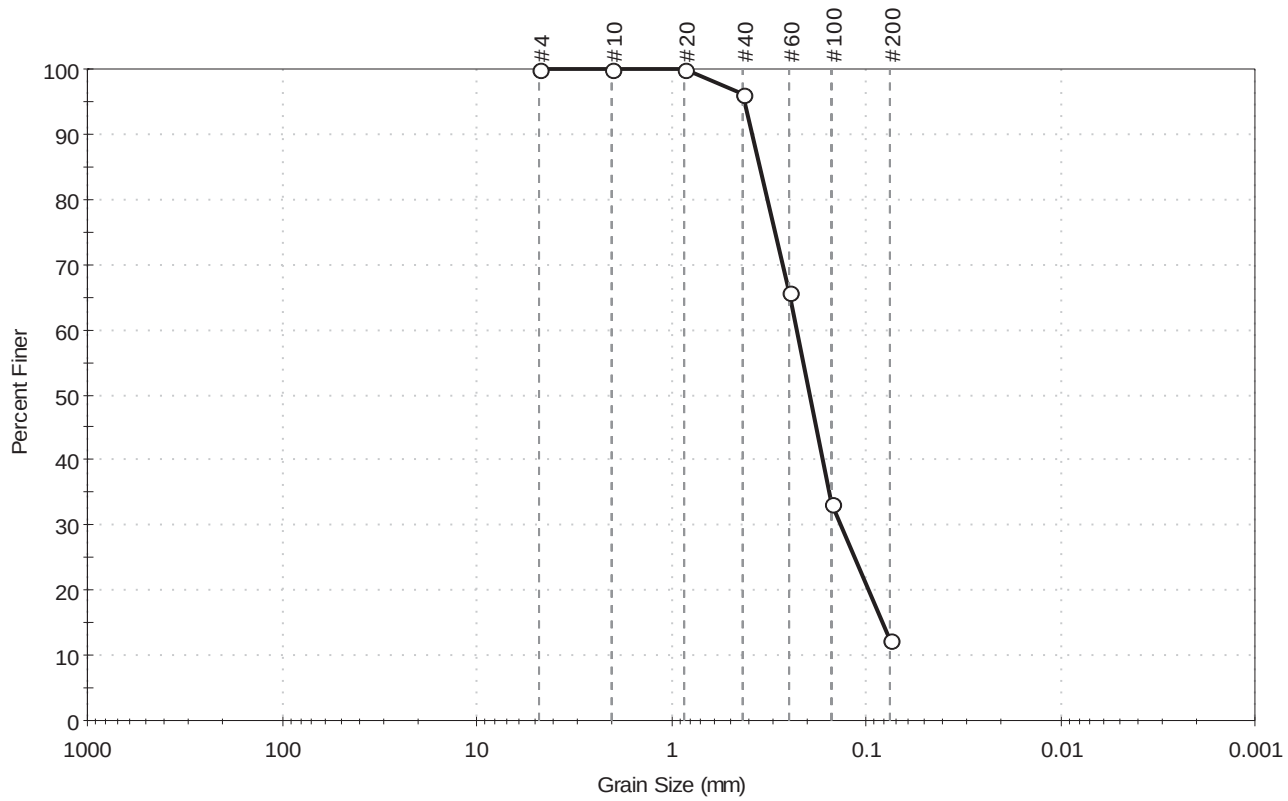
N = Sum of Second and Third 6" Blow Counts

Terms Used for Second Entry of Descriptions: and = 40-50%, some = 10-40%, trace = 10% or less

Client:	AECOM				
Project:	Plymouth Rt 44 Design				
Location:	Plymouth, MA			Project No:	GTX-302558
Boring ID:	B-18	Sample Type:	jar	Tested By:	jbr
Sample ID:	3D	Test Date:	11/21/14	Checked By:	emm
Depth :	9-11 ft	Test Id:	314762		

Test Comment: ---
Sample Description: Moist, light brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	87.7	12.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	96		
#60	0.25	66		
#100	0.15	33		
#200	0.075	12		

Coefficients

D_{85} = 0.3500 mm D_{30} = 0.1344 mm
D_{60} = 0.2280 mm D_{15} = 0.0820 mm
D_{50} = 0.1949 mm D_{10} = 0.0696 mm
C_u = 3.276 C_c = 1.138

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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SECTION 01400

QUALITY ASSURANCE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section covers Quality Assurance and Control requirements for this contract.

B. The Contractor is responsible for controlling the quality of work, including work of its subcontractors, and suppliers and for assuring the quality specified in the Technical Specifications is achieved.

C. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 TESTING LABORATORY SERVICES

A. All tests which require the services of a laboratory to determine compliance with the Contract Documents, shall be performed by an independent commercial testing laboratory acceptable to the Engineer. The laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.

B. Preliminary Testing Services: Unless otherwise specified, the Contractor shall be responsible for all testing laboratory services in connection with concrete materials and mix designs, the design of asphalt mixtures, gradation tests for structural and embankment fills, backfill materials, and all other tests and engineering data required for the Engineer's review of materials and equipment proposed to be used in the Work. The Contractor shall obtain the Engineer's acceptance of the testing laboratory before having services performed, and shall pay all costs for services.

C. Quality Control Testing Services: Perform all quality control tests in the field or in the laboratory on concrete, asphalt mixtures, moisture-density (Proctor) and gradation tests on structural and embankment fills, and backfill materials, in-place field density tests on structural and embankment fills, and other materials and equipment, during and after their incorporation in the Work. Field sampling and testing shall be performed in the general manner indicated in the specifications, with minimum interference with construction operations. The Engineer shall determine the exact time and location of field sampling and testing, and may require such additional sampling and testing as necessary to determine that materials and equipment conform with data previously furnished by Contractor and with the Contract Documents.

D. Arrangements for delivery of samples and test specimens to the testing laboratory will be made by the Contractor. The laboratory tests shall be performed within a reasonable time consistent with the specified standards. Furnish a written report of each test to the Engineer.

E. Contractor shall furnish all sample materials and cooperate in the sampling and field testing activities, interrupting the Work when necessary. When sampling or testing activities are performed in the field, the Contractor shall furnish personnel and facilities to assist in the activities.

F. The Contractor shall not retain any testing laboratory against which the Engineer has reasonable objection, and if at any time during the construction process the services become unacceptable to the Engineer, the Engineer may direct in writing that such services be terminated. The request must be supported with evidence of improper testing or unreasonable delay. If the Engineer determines that sufficient cause exists, the Contractor shall terminate the services and engage a different testing laboratory.

G. Transmittal of Test Reports: Written reports of testing and engineering data furnished by the Contractor for the Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.

H. The testing laboratory shall furnish four copies of a written report of each test performed by laboratory personnel in the field or laboratory to the Contractor. Distribution shall be two copies of each test report to the Engineer and one copy for the Contractor within three days after each test is completed.

1.03 QUALITY ASSURANCE

A. Copies of applicable referenced standards are not included in the Contract Documents. Where copies of standards are needed by the Contractor for superintendence and quality control of the work, the Contractor shall obtain a copy or copies directly from the publication source and maintain at the jobsite, available to the Contractor's personnel, subcontractors, and Engineer.

B. Quality of Materials: Unless otherwise specified, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards and specifications and shall be new, unused, and free from defects and imperfections, when installed or otherwise incorporated in the Work. Material and equipment shall not be used by the Contractor for any purpose other than that intended or specified unless such use is authorized by the Engineer.

C. Where so specified, products or workmanship shall also conform to the additional performance requirements included within the Contract Documents to establish a higher or more stringent standard or quality than that required by the referenced standard.

1.04 OFFSITE INSPECTION

A. When the specifications require inspection of materials or equipment during the production, manufacturing, or fabricating process, or before shipment, such services shall be performed by an independent testing laboratory, or inspection organization acceptable to Engineer in conjunction with or by the Engineer.

B. The Contractor shall give appropriate written notice to the Engineer not less than 30 days before offsite inspection services are required, and shall provide for the producer, manufacturer, or fabricator to furnish safe access and proper facilities and to cooperate with inspecting personnel in the performance of their duties.

C. The inspection organization shall submit a written report to the Contractor who shall provide copies to the Engineer.

1.05 MATERIALS AND EQUIPMENT

A. The Contractor shall maintain control over procurement sources to ensure that materials and equipment conform to specified requirements in the Contract Documents.

B. The Contractor shall comply with manufacturer's printed instructions regarding all facets of materials and/or equipment movement, storage, installation, testing, startup, and operation. Should circumstances occur where the contract documents are more stringent than the manufacturer's printed instructions, the Contractor shall comply with the specifications. In cases where the manufacturer's printed instructions are more stringent than the contract documents, the Contractor shall advise the Engineer of the disparity and conform to the manufacturer's printed instructions. In either case, the Contractor is to apply the more stringent specification or recommendation, unless approved otherwise by the Engineer.

1.06 SHOP AND FIELD TESTING

A. The Contractor is also responsible for providing the shop and field testing specified in the technical specification sections.

B. The Contractor and its Subcontractor shall perform inspections, tests, and other services as required by the Contract Documents.

C. Contractor shall provide twenty one days notice to the Engineer so that the Engineer may witness Contractor and/or Subcontractors off site and on site tests. The Engineer's witnessing of tests does not relieve the Contractor and/or Subcontractors of their obligation to comply with the requirements of the Contract Documents.

1.07 MANUFACTURER'S FIELD SERVICES

A. When specified in the technical specifications sections, the Contractor shall arrange for and provide technical representation from manufacturer's of respective equipment, items or components. The manufacturer's representative shall be a factory trained service engineer/technician with the type and length of experience specified in the technical specifications.

B. Services Furnished Under This Contract: An experienced, competent, and authorized factory trained service engineer/technician representative of the manufacturer of each item of equipment for which field services are indicated in the specifications shall visit the site of the Work and inspect, operate, test, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's service representative shall be present when the equipment is placed in operation. The manufacturer's service representative shall revisit the jobsite as often as necessary until all problems are corrected and the equipment installation and operation are satisfactory to the Engineer.

C. For equipment supplied by the Engineer, Contractor shall coordinate with the equipment supplier to obtain similar factory trained service engineer service.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 QUALITY CONTROL

A. Quality control is the responsibility of the Contractor, and the Contractor shall maintain control over construction and installation processes to assure compliance with specified requirements.

B. Certifications for personnel, procedures, and equipment associated with special processes (e.g., welding, cable splicing, instrument calibration, surveying) shall be maintained in the Contractor's field office, available for inspection by the Engineer. Copies will be made available to the Engineer upon request.

C. Means and methods of construction and installation processes are the responsibility of the Contractor, and at no time is it the intent of the Engineer to supersede or void that responsibility.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes the furnishing of all labor, tools, equipment and materials, performing all operations necessary to provide temporary facilities as specified herein and as directed by the Engineer.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. No construction activities is allowed to occur until the Engineer’s Field Office has been completely set-up and operational.

C. No payment applications shall be processed until the Engineer’s Field Office has been completely set-up and operational.

1.03 DEFINITIONS

A. Definitions shall be as specified in DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS – Not Used

PART 2 PRODUCTS

2.01 TEMPORARY BUILDINGS

A. Furnish temporary offices, storage and fabrication facilities as required and obtain all necessary applicable permits and/or approvals required for their use. Such buildings shall be located as required and as to not interfere with the work of the project and shall be completely removed at the completion of the work.

B. Engineer's Field Office

1. Provide at the start of the work and for the duration of the project, unless otherwise directed, a field office for the use of the Engineer. The office shall be of approximately 500 square feet divided into two rooms plus a lavatory with hot and cold running water and a closet. Legally dispose of sanitary wastes. The office and rooms shall be constructed in a manner, and of materials, satisfactory to the Engineer. Office shall be weathertight with a minimum of six windows and two exterior doors. The office shall be adequately lighted for detailed working conditions, heated and air conditioned during the appropriate seasons (each room to be individually controlled). Thoroughly clean and mop the trailer on a weekly basis and shall restock all paper products such as but not limited to cups, towels, toilet paper, office copy paper, printer paper, printer toner, and plastic liners for waste baskets.

a. The rooms shall be designated Room "A" and Room “B” and of the approximate sizes: Room "A" - 150 square feet and Room "B" - 350 square feet. Separate entrances shall be provided to each Room.

b. Furniture, furnishings and equipment subject to approval of the Engineer, shall be provided in the designated rooms as follows:

(1) Room "A"

1 - Executive desk

2 - Executive chairs

1 - Bookcase (6' high x 3' wide)

1 - 4 drawer steel filing cabinet (locking, legal size)

1 - Cordless telephone (with hands free speaker and speed dialing)

1 - Telephone answering machine with recorder

1 – HP Office Jet Pro 8600 e-All-In-One Printer. Provide paper and other expendables for the project duration

1 – Canon - EOS Rebel T5i DSLR Camera with 18-55mm IS STM Lens

1 - Fire extinguisher

1 - Waste basket

(2) Room "B"

2 - Tables (2'-6” x 6'-0”)

1 - Plan table (3’-0” x 5’-0”)

1 - Plan rack (mobile stand and handling clamps by rack manufacture)

1 - 4 drawer steel filing cabinet (locking, legal size)

10 - Folding metal chairs

1 - Water Cooler/Heater with up to five 5-gallon supply containers furnished per month for the duration of the contract

1 - 2.5 cubic foot refrigerator

1 - Small microwave oven

1 - Color copy machine, self-feeding, with 8-1/2" x 11" and 11" x 17" printing capability, enlargement/reduction capability, and scanning capability. Provide cartridges, toner, paper, etc., for the project duration

1 - Push broom and dust pan

1 - First aid kit

1 - Fire extinguisher

1 - Waste basket

2. The office shall be located at the work site where it will not interfere with the construction work. Space shall be provided with crushed stone base for at least three vehicles adjacent to the office for the exclusive use of the Engineer and visitors. Remove snow, mud, and control dust in the parking area adjacent to the office.

2.02 TEMPORARY OPERATIONS

A. General

1. The Contractor shall conduct operations in such a manner and sequence that shall neither result in a disruption of the amenities, nor interfere with the functional organization and workings of existing infrastructure.

2. The Contractor is required to provide all temporary facilities required to maintain the operation of the existing infrastructure.

3. The Contractor shall prepare a carefully planned and detailed construction schedule showing the proposed sequences of operation and the methods to be used for maintaining continued operations of existing infrastructure. No payment will be made until the carefully planned and detailed construction schedule has been developed by the Contractor and approved by the Owner and the Engineer. The following provides the minimum requirements to be addressed by the Contractor while preparing the construction schedule. It should be noted that the following is not intended to be all inclusive.

B. In order to maintain continuous operations during construction, the Contractor is required to furnish, install, maintain and remove all necessary temporary by-pass systems. The Contractor shall fully maintain the temporary by-pass systems at all times. The temporary by-pass systems shall include, but is not limited to, piping, valves, flow control devices, electrical connections, and power supply, if necessary. The temporary by-pass equipment shall be remain in operation and be fully maintained by the Contractor until the applicable equipment or system has been approved by the Engineer and approved by the Owner.

PART 3 EXECUTION

3.01 TELEPHONE SERVICES

A. Provide separate temporary telephone services in the field offices for use by the Contractor, subcontractors and the Engineer up to the time of final acceptance of the project.

B. The Engineer’s Field Office shall be provided with separate services for two telephone lines and one facsimile line.

3.02 WATER

A. Make connections to the nearest municipal water supply and use this supply for construction purposes. Any portions, which are to become a part of the permanent system, shall conform to the applicable sections of these specifications.

B. Furnish, maintain and subsequently provide the water meters and backflow preventers at each location. Furnish all extensions required. Provide drinking water, satisfactorily cooled.

3.03 ELECTRICITY

A. Arrange for, furnish and maintain all expenses for all electricity required for proper lighting, the use of power tools, for temporary heat for construction operations and for field offices up to the time of final acceptance of the project.

B. Furnish all wiring, fixtures, lamps and other accessories required for his or his subcontractors' work, and for proper lighting, the use of power tools and for temporary heat for construction operations up to the time of final acceptance. Power shall be obtained directly from power company lines or from portable, gasoline driven generator sets.

3.04 SANITARY CONVENIENCES

A. Provide sanitary conveniences for the duration of the project for the use of all persons employed on the project, including all other contractors and subcontractors.

B. Sanitary conveniences shall be properly screened from public observation, provided in sufficient numbers, and in such manner and at such points as shall be approved by the Engineer and/or Owner. The contents shall be removed and legally disposed of at a frequency acceptable to the public health agency having jurisdiction or as required.

3.05 PROJECT SIGNS – Not Used

3.06 BARRICADES AND GUARD LIGHTS

A. Barricades, signs, fences and similar safety and warning devices shall be provided as required, in order to insure the protection of employees and others concerned with their duties and presence on the premises at the project site.

B. Provide and maintain guard lights at all barricades, obstructions in plant ways, and at all trenches and pits adjacent to traveled ways.

C. Provide temporary chain link fencing around the entire project site at the limit-of-work. The temporary chain link fencing shall be constructed to limit the access to the site. The site shall be secured by means of locked gates during the periods of no construction activities. The temporary chain link fencing shall be 6 foot high with concrete base supports and shall meet all federal, state and local rules and regulations.

3.07 TEMPORARY HEAT

A. During the months of October through April, provide heat, fuel and services necessary to protect all of the work and materials against injury from dampness and cold and to maintain temperature above 55 degrees F in all enclosed portions of the project. Provide temporary heating devices, electrical power, adequate and proper fuel, fire enclosures, and the like, as required for the work of all trades, and shall have watchmen constantly in attendance when fires are burning. Only Underwriters' Laboratory approved equipment shall be used. Open salamanders will not be allowed.

B. The permanent heating system may be used for temporary heat prior to the occupancy of the buildings by the Owner, or as otherwise approved by the Engineer, however, the use of permanent equipment for temporary heat purposes shall not affect the guarantee period stated elsewhere in these specifications. Operate and maintain the heating system (including fuel) and the equipment used for temporary heat until final completion of the project, and repair and replace all items damaged during temporary use. Clean all of the permanent heating equipment if it is used for temporary heat before turning the system over to the Owner.

3.08 TEMPORARY CLOSURES

A. Temporary doors and closures for all openings shall be furnished and installed to keep out inclement weather and intruders until the permanent units are installed. Any loss or damage caused by failure to comply with the above provisions shall be replaced and/or repaired at no additional cost to the Owner.

3.09 SCAFFOLDING

A. Furnish, erect, maintain in a safe condition and remove all scaffolding required for the execution of the work not specified as being furnished under other sections herein.

B. Neither the Engineer nor the Owner will act as an arbitrator on questions of whether the Contractor or any of his subcontractors shall furnish or remove scaffolding required for any portion of the work.

3.10 SHELTER AND PROTECTION OF MATERIALS

A. Provide adequate storage facilities for all materials required for the work. The facilities shall be enclosed, heated and provided with moisture control, as required to provide adequate protection and shall be satisfactory to the Engineer.

3.11 BRACING, SHORING AND SHEETING

A. Provide all bracing, shoring and sheeting as required for safety and for the proper execution of work. Unless otherwise ordered by the Engineer, all bracing, shoring, and sheeting shall be removed when work is completed.

END OF SECTION

SECTION 01570

TRAFFIC MANAGEMENT AND MAINTENANCE

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes furnishing all engineering, materials, labor, and equipment required for traffic management and maintenance on state highways and/or municipal roadways within the limits of construction under this contract.

B. All practices and traffic control devices shall conform to the relevant provisions of Section 850 of the Massachusetts Department of Public Works (hereinafter called State) Standard Specifications for Highways & Bridges (latest edition) and the Manual on Uniform Traffic Control Devices (MUTCD), including latest amendments and addenda.

C. Develop a traffic management plan to be reviewed and approved by the Owner, state, local, and/or jurisdictional agencies as appropriate. The traffic management plan shall meet with standard practices of the above references, requirements of this specification, and special requirements required by the project.

D. Furnish adequate notice to police and fire departments, public transportation authorities, and school departments/districts of the proposed traffic maintenance plan including, but not limited to, detours, lane closures, and alternate routes.

E. Furnish, erect and maintain traffic control devices, as required by the traffic maintenance plan. Provide traffic control devices including lights, markings, barricades, warning signs, and all other safety precautions necessary to protect streets, sidewalks, access to adjoining property, and the traveling public within the area of the construction. Reference is made to the drawings for general guidelines for typical traffic control devices and their placements. These are intended as a guide only, and do not necessarily include all possible warning devices, control devices, or police details, which may be required by the project.

F. Remove, replace and/or reposition all traffic control devices, as necessary.

G. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT and as follows:

1. Any traffic control devices provided under this section which are lost, stolen, destroyed or deemed unacceptable while in use on the project, shall be immediately replaced at no additional cost to the Owner.

2. Uniformed Police Officers shall be paid for in accordance with GENERAL INFORMATION, DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01025, MEASUREMENT AND PAYMENT.

3. No payment shall be made for any work on this project until a Traffic Management Plan has been developed, submitted and approved by the Owner and/or Engineer.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Traffic Management Plan.

2. Written Approval of the Traffic Management Plan from the Owner’s Safety Officer.

1.04 PRODUCT HANDLING – Not Used

1.05 SPECIAL REQUIREMENTS

A. Notify the Owner, state, local, and/or jurisdictional agencies well in advance of commencing construction. Arrange all detours, partial road closures, and alternate traffic patterns. Inform emergency departments on the daily status of project roadways.

B. Arrange for the services of uniformed police officers, as required to protect and facilitate the flow of vehicular and pedestrian traffic through the construction work zone.

C. During winter months, remove snow and prevent ice conditions within active construction work zones, and assist local or state agencies in clearing roads used as detour routes to facilitate uninterrupted movement of traffic.

PART 2 PRODUCTS

2.01 SAFETY CONTROLS AND SIGNING FOR CONSTRUCTION OPERATIONS

A. All signs, barricades and drums shall have reflective sheeting, in accordance with Subsection M9.30.0 Materials of the State Standard Specifications.

B. Utilize sandbags or provide other suitable means to weigh down Portable Breakaway Barricades Type III, to minimize the disturbance of barricades by vandals.

C. Furnish, erect and maintain throughout the construction period warning and directional signs.

D. All traffic control devices not conforming in type, composition, and size to the standards specified herein shall not be used under this contract.

E. Each day, remove or cover all erected signs not consistent with the use of the roadway.

2.02 FLAGS FOR ADVANCE WARNING SIGNS

A. Standard orange or red-orange flags (16 inch by 16-inch minimum) shall be mounted on all advance work area signs. Flags shall be mounted as shown in MUTCD and shall not interfere with a clear view of the sign face.

2.03 TEMPORARY PRECAST CONCRETE BARRIER

A. Temporary Precast Concrete Barriers shall conform to Section 629 of the State Standard Specifications for Highways and Bridges.

B. Furnish, set up, move, maintain, and remove Temporary Precast Concrete Barriers, when positive traffic barriers are needed for traffic control and safety in construction zones.

C. Each run or bay of Temporary Precast Concrete Barrier units shall be installed and fastened together to form a continuous chain, in accordance with the requirements of the state or local agencies having jurisdiction.

2.04 PORTABLE BREAKAWAY BARRICADE TYPE III

A. Portable Breakaway Barricades, Type III shall be a 4 foot unit and conform to the latest edition of the State Construction Standards, as shown on the drawings and any additional requirements of this specification.

B. Reflectorized sheeting shall conform to Subsection M9.30.0. of the State Standard Specifications. Alternating 6 inch wide stripes shall be orange and white and shall slope downward at 45 degrees toward the end by which traffic is to pass. Pipe shall be Polyvinyl Chloride (PVC) pressure rated SDR 26 conforming to ASTM D2241. Fittings may be PVC conforming to ASTM D2665 or Acrylonitrile Butadiene Styrene (ABS) conforming to ASTM D2661 (Drainage Waste and Vent).

C. Furnish, set up, move, maintain (in good and serviceable condition), and remove Portable Breakaway Barricades Type III, as required by the performance of this work or as may be required by jurisdictional authorities, at no additional cost to the Owner.

2.05 PORTABLE BARRIER FENCE

A. Construction of Portable Barrier Fences shall be as shown on the drawings. Include the necessary signs, reflectors, and all incidental equipment in order to provide the portable barrier fence, complete in place.

2.06 REFLECTORIZED DRUMS WITH OR WITHOUT WARNING LIGHTS

A. Reflectorized drums shall conform to Subsection M9.30.0 of the State Standard Specification and shall be as shown on the drawings. Other drum-type products providing equivalent target value and stability, and accepted by the State, may be used.

B. Drums shall be used in the protection of driveways, utility structures, and pedestrian control and safety throughout the construction period.

C. Warning lights shall conform to the MUTCD Subsection 6F.72 for Type A or Type C. Drums shall be maintained in a satisfactory manner including the removal of dirt or road film that may cause a reduction in reflective efficiency. Type A, Low Intensity Flashing Warning Lights, mounted on drums, shall be used to continually warn drivers that they are approaching or proceeding in a hazardous area. Type C, Steady-Burn Lights, placed in a series on drums, shall be used to delineate the proper vehicle path through construction areas (which require changing patterns of traffic movement).

D. Furnish, set up, move, maintain (in good and serviceable condition), and remove reflectorized drums with or without warning lights as required by the performance of his work or as directed by jurisdictional authorities, at no additional cost to the Owner.

2.07 SPECIAL LIGHTING UNITS (FLASHING ARROW)

A. Special Lighting Units shall consist of a black background panel meeting the requirements of the MUTCD Subsection 6F-53, Figure 6F-3 for Type C and shall contain at least 15 No. 4412A (or equal) amber lights with approximately 8,000 initial maximum candlepower each. Each Special Lighting Unit shall automatically provide for a minimum of 50 percent dimming from their rated lamp voltage at night. The flashing rate of the lamps shall not be less than 25 nor more than 40 flashes per minute. The arrow panels shall have the capability of the following mode selections: (1) left or right flashing or sequential arrows; and (2) double flashing arrows.

B. Special Lighting Units shall be as specified in Subsection 850.46 of the State Standard Specifications.

C. Minimum height should be seven feet above the roadway to the bottom of the panel.

2.08 VARIABLE MESSAGE SIGNS

A. The Contractor shall provide up to four temporary variable message signs to provide advance warning to motorists prior to entering the construction area. The variable message signs shall be available for immediate use throughout the duration of the project and be positioned in accordance with the Temporary Traffic Control Plan and/or at the direction of the Engineer. If the unit is found to be defective in any way it shall be replaced immediately at the Contractor’s expense.

B. The temporary variable message signs display shall be full matrix LED signs utilizing 18-inch high characters on a display of 3 rows of characters with a minimum of 8 characters per line. The variable message signs shall have an encryption feature that provides data security.

C. Variable message signs shall be Sunray 480 as manufactured by National Sign Incorporated, or equal.

2.09 TEMPORARY PAVEMENT MARKINGS AND RAISED PAVEMENT MARKERS

A. Paints, tapes, and glass beads used for temporary pavement markings shall conform to Subsections M7.01. of the State Standard Specifications. Other material, which will provide satisfactory durability and reflectivity, and accepted, by the Massachusetts Department of Transportation, may be used. The reflectivity of temporary pavement markings shall be equal to or better than the Massachusetts Department of Transportation minimum requirements for a period of 90 days. The colors of the marking materials shall be white, yellow or black.

B. Raised pavement markers shall conform to Subsection M9.30.6 of the State Standard Specifications.

PART 3 EXECUTION

3.01 PERFORMANCE

A. Furnish, erect and maintain suitable barriers, barricades, signs, markings, drums and all other traffic control devices necessary to protect all roadways, which are partially obstructed or closed to vehicular or pedestrian traffic, as a result of this project.

B. The Owner reserves the right to suspend work, if inadequate traffic control devices are provided to control and protect both vehicular and pedestrian traffic.

C. Completely backfill all trenches at the end of each workday and/or when work is suspended for indefinite periods. In addition, install temporary trench patch each and every Friday.

D. All damage to the work, pedestrians and/or public/private property due to failure to place or maintain adequate warning or directional signs or other traffic control devices shall be corrected and/or replaced at no additional cost to the Owner.

E. Furnish, supply, maintain and remove temporary white and/or yellow reflectorized and/or black non-reflectorized pavement markings, as required by the performance of his work or as directed by jurisdictional authorities, at no additional cost to the Owner. For the purpose of this specification, temporary markings shall mean markings with an effective marking period of 90-days.

F. Remove existing pavement markings as required by the performance of his work or as directed by jurisdictional authorities, at no additional cost to the Owner. Pavement marking removal methods shall not cause damage to the pavement or cause significant change in its texture. Any damage to the pavement or surfacing caused by pavement marking removal shall be satisfactorily repaired, at no additional cost to the Owner.

G. Provide all necessary temporary pavement markings, and/or temporary raised pavement markers following the completion of each week's operation, change in detour routing or prior to opening the roadway to traffic. Make all necessary arrangements for this work, as required. Continually replace the temporary pavement markings until the final pavement markings have been provided on the final pavement.

H. Transport and relocate any or all signs, barriers, barricades, or other safety devices as specified herein, as required or directed during the project. No additional payment will be provided for relocating and removing traffic control devices.

3.02 TRAFFIC MANAGEMENT PLAN

A. The hours of operation shall be limited as required by permitting agencies and/or as required by the municipality.

B. L = S x W for speeds of 45 mph or more and/or L = WS/60 for speeds of 40 or less where:

1. L = minimum length of taper

2. S = numerical value of posted speed limit prior to work or 85th percentile speed

3. W = width of offset

C. The maximum spacing between channelizing devices in a taper should be approximately equal in feet to the speed limit.

D. The maximum spacing between channelizing devices should be approximately equal in feet to two times the speed limit.

E. Channelizing devices are to be extended to a point where they are visible to approaching traffic.

F. Warning lights (steady burn Type C) should be used to mark channelizing devices at night as needed.

G. Pavement markings no longer applicable which could create confusion shall be removed. Temporary pavement markings shall be used as necessary and shall be in place prior to work completed each night.

H. Signs and sign supports shall meet criteria in National Cooperative Highway Research Program (NCHRP) 350. No signs shall be attached to drums or cones. All signs shall be attached to independent supports.

I. Exact location of signs shall be approved by the engineer. Distances may be adjusted slightly to meet with field conditions.

J. All traffic control signs such as W20-4 and W20-8 shall be completely covered or removed at the end of each work day or when otherwise not in effect.

K. Advisory speed (W13-1) at site to be determined by the municipality prior to the start of construction.

L. As required by the local safety officer, police details shall be used to direct traffic around a work area if traffic must be temporarily stopped or rerouted to allow for movement of work vehicles or other equipment.

M. As required by the local safety officer, in low volume traffic roadways, if the entire work area is visible from one station, a single police officer may be used. A single officer shall be stationed on the shoulder opposite the obstruction or work place or in a position where good visibility and traffic control can be maintained at all times.

N. As required by the local safety officer, in areas of heavy traffic volume or critical work areas, 2 or more police officers shall be used. Where 2 or more police officers are required, all police officers must be in communication with each other and should be clearly visible to the traffic which is being controlled.

O. Flood lights should be provided to mark police detail stations at night as needed.

P. Operation of traffic signal controls at intersections should be coordinated with local authorities.

Q. All open trenches covered with steel plates during construction shall be protected by a slope of 4 horizontal to 1 vertical.

R. The contractor shall square off full width of roadway (10:1 slope) at the end of each work day, where applicable.

S. At the end of the work day the contractor shall ensure that safe access/egress of all driveways, entrances and exits are maintained during night time and on weekends.

T. If detour plans which use local roadways are required, they must be approved by engineer in writing prior to commencing work.

3.03 VARIABLE MESSAGE SIGNS

A. Variable Message Signs shall be positioned in accordance with the traffic control plan and/or at the direction of the Engineer. The signs shall be visible from a minimum distance of 900 feet with a viewing angle of no less than 30 degrees. The Contractor shall take appropriate measures as needed within the roadway layout to provide the required minimum sight distance. The Contractor shall be responsible for the maintenance of each device and appurtenance.

B. The Contractor shall be responsible for all maintenance associated with all temporary variable message signs. This includes, but is not limited to knockdowns, power outages, equipment malfunctions, temporary modifications to support the traffic control plan during construction and any other incidents within the project limits.

C. The Contractor shall coordinate with MassDOT and the Owner to finalize the variable message sign locations and text. Signs shall not be placed on private property or on sidewalks.

END OF SECTION

SECTION 01640

SPECIAL MECHANICAL AND ELECTRICAL EQUIPMENT REQUIREMENTS

PART 1 GENERAL

1.01 SUBSTITUTION OF EQUIPMENT

A. This project has been designed to accommodate specific models of equipment of the manufacturers specified. Substitution of different models of specified manufacturers equipment or equipment of manufacturers not specified may be submitted to the Engineer for consideration. Should the Engineer approve the substitution then any redesign of the project including structural, architectural, electrical, process piping and/or any other affected Work to receive the substitution shall be done at no additional cost to the Owner. A Professional Engineer and/or Architect licensed in the state where the Project is located shall perform redesign work, which is subject to final approval by the Owner prior to initiation.

1.02 SPECIAL REQUIREMENTS FOR PUMPS

A. Except as otherwise specified, all pumping units furnished for the Work of this contract shall have bearings with a B-10 bearing life of not less that 100,000 hours.

1.03 ELECTRIC MOTOR REQUIREMENTS

A. General

1. This specification details the mechanical and electrical requirements for Premium energy-efficient, totally enclosed fan-cooled and totally enclosed non-ventilated squirrel-cage induction motors, NEMA frame size 182T through 449T.

2. It is the intent of this specification to define premium quality motors which will provide energy efficient operation with high mechanical integrity under adverse operating conditions for maximum life and minimum life cycle costs.

3. Each motor furnished shall in all respects incorporate the highest quality of modern engineering design and workmanship and shall conform to all specifications of this paragraph. Rating and characteristics, materials, and constructions shall be in accordance with the latest edition of NEMA MG1, ANSI C50 and IEEE standards as applicable.

4. This specification intends to define broad standards of design and construction but not details. The motors shall be constructed and equipped with accessories in accordance with the manufacturer's practice whereby they do not conflict with these specifications.

B. Design Characteristics

1. The type of motor required for each application is specified with the driven equipment.

2. Unless otherwise specified, motors 1/2 horsepower and larger shall be 3 phase, 60 hertz, 230/460 volts with nine (9) leads. Motors less than 1/2 horsepower shall be single phase, 60 hertz, 115 volts.

3. All motors shall have a 1.15 service factor, unless specified otherwise.

4. Motors shall not be loaded beyond the nameplate rating over the entire pump curve range and shall not operate within the service factor rating.

C. Warranty

1. Motors shall be free from defects in materials and workmanship and shall be guaranteed to operate satisfactorily when properly applied for one (1) year from date of acceptance.

D. General

1. Motors shall be as manufactured by Reliance XE, or equal as manufactured by General Electric Company or U.S. Electrical Motors Division.

2. All motors covered by this specification shall conform to the latest applicable requirements of NEMA, IEEE, ANSI, and NEC standards.

3. Motors are to be designed for continuous duty for 3-phase service and NEMA design B unless otherwise specified.

4. Ratings to be based on a 40-degree C. ambient, 3,300 feet (1000m) altitude or lower operation, with a maximum temperature rise of 80 degree by resistance C at 1.0 service factor and 90 degree C rise 1.15 service factor through 150 horsepower.

5. Motors to be furnished with Class F insulation, 1.15 service factor but shall be selected for operation within their full load rating without applying the service factor.

6. Motors shall be of a premium efficient design and shall be different from the manufacturer's standard efficient product.

7. Motors shall meet or exceed all applicable NEMA torque standards for Design B motors as stated in NEMA standards MG1 - 12.37 and MG1 - 12.38 or MG1 - 20.41.

8. Where a specific torque is specified for a particular pump, those motors shall be designed as specified.

E. Mechanical

1. Bearings and Lubrication

a. Bearings shall be ball, open, single row, deep groove, Conrad type, and shall have a Class 3 internal fit conforming to AFBMA Std. 20. For belted duty applications, drive end bearing may be cylindrical roller type.

b. Bearing shall be selected to provide L10 rating life of 17,500 hours minimum for belted applications. 100,000 hours minimum for flexible direct coupled applications. Calculations shall be based on external loads using NEMA belted applications limits per MG1–1993–14.07 and typical sheave weights and internal loads defined by the manufacturer including magnetic pull and rotating assembly weight.

c. Bearing temperature rise at rated load shall not exceed 60 degrees C 3600 RPM or 50 degree C 1800 RPM and slower. Temperature rise is to be measured by RTD or thermocouple at bearing outer race.

d. All data specific to the motor design including bearing AFBMA identification number shall be stamped on motor nameplate.

e. Motor lubrication system shall consist of a grease inlet on motor bracket with capped grease fitting on inlet, grease relief plug 180 degree from inlet, grease reservoir in bracket and grease reservoir in cast inner cap.

f. Motor to be greased by manufacturer with a premium moisture resistant polyurea thickened grease containing rust inhibitors and suitable for operation over temperatures from -25 degrees C to 120 degrees C.

g. Bearings shall be protected by INPRO/SEAL bearing isolators on both ends of the motor.

2. Enclosures

a. Motor enclosure including frame with integrally cast feet, end brackets, locking bearing inner caps, fan guards, and conduit box and cover shall be cast iron, ASTM Type A–48, Class 25 or better.

b. Motor conduit box shall be cast iron construction, rotatable in 90 degree increments, diagonally split with tapped NPT threaded conduit entrance hole. Neoprene conduit box cover gasket and neoprene lead seal gasket between box and motor frame shall be furnished. Provision for grounding shall be provided in the conduit box utilizing a mounted clamp type ground lug.

c. External cooling fan shall be corrosion resistant, non sparking, bi directional, keyed, clamped and shouldered on the motor shaft.

d. Motor rotor construction shall be die cast aluminum or fabricated copper or their respective alloys. Rotors on frames 213T and above shall be keyed to shaft and rotating assembly dynamically balanced to and .0005 inches peak-to-peak 182T-326T frames, and .00075 inches peak-to-peak 364T-449T frames. Balance weights, if required, shall be secured to the rotor resistance ring or fan blades by rivets. Machine screws and nuts are prohibited. The entire rotating assembly between bearing inner caps shall be coated with corrosion–resistant epoxy.

e. Stainless steel automatic breather drains shall be provided in the lowest part of both front and back end brackets to allow drainage of condensation.

f. All mounting hardware shall be hex head, high strength, SAE Grade 5, plated for corrosion protection. Screwdriver slot fasteners are prohibited. A forged steel shouldered eyebolt shall be provided on all frames. Eyebolt receptacle shall be threaded and designed to prevent moisture or foreign material from entering motor when eyebolt is removed.

g. Corrosion resistant stainless steel nameplate shall be affixed to motor frame with stainless steel or brass drive pins. Nameplate(s) shall include all applicable NEMA data and AFBMA bearing numbers, and connection diagram for dual voltage motors.

h. An external V–Ring shaft slinger shall be provided on both shaft extensions 254T and larger and on the drive end shaft only 182T-215T to minimize entrance of moisture or foreign material into bearing cavity.

i. Frame to end bracket assembly of machined parts shall be protected and sealed by application of thick corrosion–resistant material to the machine surfaces prior to assembly.

j. All motor parts including frame, brackets, fan cover, and terminal box shall receive a minimum of two coats of high grade USDA accepted epoxy paint. Motor assembly must satisfactorily withstand salt spray tests for corrosion per ASTM B–117 for 96 hours.

F. Electrical

1. Motors shall successfully operate under power supply variations per NEMA MG1-14.30.

2. Motors shall be NEMA Design B with torque and starting currents in accordance with NEMA MG1-12.35 and 12.38 except in special applications requiring higher starting torques where NEMA Design C is permitted. Motors shall have copper windings.

3. Motor insulation system shall be Class F minimum, utilizing materials and insulation systems evaluated in accordance with IEEE 117 classification tests.

4. Motors used with variable frequency drive systems shall be labeled as inverter-duty type motors.

5. Motor leads shall be non-wicking type, Class F temperature rating or better and permanently numbered for identification.

6. Entire wound and insulated stator shall receive additional coating of epoxy paint on all air gap surfaces to protect against moisture and corrosion.

7. Each completed and assembled motor shall receive a routine factory test per NEMA standards.

G. Efficiency

1. All motors shall be of premium energy–efficient rated and different from the manufacturer’s standard product through the use of premium materials, design and improved manufacturing process, that reduces motor losses approximately 40% from standard efficient designs, and whose minimum efficiencies exceed NEMA MG1 Table 12–10.

2. Motors shall meet all local utility efficiency requirements and rebates, where applicable.

3. Motor efficiency shall be determined in accordance with NEMA MG1–1993–12.58.1 and full load efficiency labeled on motor nameplate in accordance with NEMA MG1-12.58.2.

1.04 POWER FACTOR CORRECTION CAPACITORS

A. All single speed, 3 phase motors, 5 horsepower and larger, excluding submersible pump motors and motors utilizing electronic starters (soft start) and variable frequency drives, shall be furnished with 3-phase power factor correction capacitors by the motor manufacturer. Capacitors shall be sized to raise no-load power factor as close to 100 percent as possible using standard size capacitors.

B. Capacitors shall be totally enclosed in dust-proof steel housings. Capacitors shall be equipped with current limiting fuses and discharge resistors. Capacitors shall be insulated with non-toxic insulating material. Provide with blow fuse indicating lights. Capacitors shall be installed under DIVISION 16 - ELECTRICAL. Two speed motors shall be furnished with a capacitor for each speed.

C. Submit data sheets and sizing calculations for each power factor correction capacitor provided.

D. Provide capacitor units as manufactured by General Electrical Co., Commonwealth Sprague or Aerovox.

1.05 NOISE SPECIFICATION FOR MACHINERY AND EQUIPMENT

A. Manufacturers shall submit sound measurements for supplied equipment in accordance with this specification. Where the sound measurements exceed the values stated below silencing provisions shall be provided to meet this standard.

B. Measurement

1. The manufacturer shall be responsible for the complete unit including any subassemblies.

2. The manufacturer shall test the equipment in accordance with the following:

Item	Applicable Standard
Duct and Fan Test Code for Sound Testing	AMCA 300-67
Rotating Electric Machinery	IEEE 85
Pneumatic Equipment	ANSI S5.1

3. Where no acceptable sound test exists or the manufacturer's standard is different from the above, the manufacturer shall submit methods of testing.

C. Submitting Data

1. The manufacturer shall submit octave sound power data for equipment. In addition, the following information is required to be submitted:

Item	Information Required
Fans	Total Sound power level at fan casing. Inlet sound power level, Outlet sound power level. Location where sound measurements are taken. Date, Time and Person Performing Testing.
Equipment Drives and Motors which exceed 5 HP	Total sound power level at the equipment casing. Locations where measurements were taken. Date, Time and Person Performing Testing.
Rotating Machinery and Miscellaneous Devices	Total sound power level at the equipment casing. Locations where measurements were taken. Date, Time and Person Performing Testing.

2. If the source is highly directional, measurements shall be taken and submitted at several locations.

D. Specified Levels

1. If the manufacturer's shows that the equipment exceeds 85 dbA, the equipment submitted shall include the additional cost and silencing provisions necessary to meet this value.

2. It is the manufacturer's responsibility to engage an independent consultant, as required, in order to meet the noise requirements stated in this specification.

   a. The manufacturer shall not ship any equipment that exceeds the values specified in this specification.

   b. If the manufacturer needs to perform tests at the purchaser's facility it shall be included at no additional cost to the Owner.

E. All equipment supplied herein shall not exceed the specified levels. If requested by the Engineer, sound measurement tests shall be made on the installed equipment. If noise levels exceed specified requirements, pay for all testing; if noise levels do not exceed the specified requirements, the Owner will bear the costs of the testing.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to: Closeout procedures; Final Cleaning; and Adjusting.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.

B. Provide submittals to Engineer that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, pervious payment, and sum remaining due.

1.03 FINAL CLEANING

A. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Remove labels that are not permanent labels.

2. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean.

3. The installing Subcontractor shall wipe surface of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

4. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

1.04 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes all labor, equipment, tools, and materials necessary for the performance of all operations in connection with clearing and grubbing, and the removal of pavement, curbing and all incidental and appurtenant work pertaining thereto, as specified herein, and as shown on the drawings.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS - Not Used

1.05 PRODUCT HANDLING - Not Used

1.06 SPECIAL REQUIREMENTS

A. Prior to the performance of any work of this section or any related work required by other sections of the specifications, the Limit of Work Line shall be laid out and staked in the field by the Contractor, according to the drawings. The Contractor shall be responsible for maintaining the Limit of Work Line during the construction operation.

B. At all times throughout the duration of this contract, the Contractor shall be responsible for the appearance and condition of the area within and surrounding the project site. The Contractor shall repair or replace, at no additional expense to the Owner, any structures, either natural or man-made such, as but not limited to, utilities, trees, plants, water bodies, and pavements that are damaged or destroyed by any actions or sequences of events related to the Contractor's operations.

C. Any existing plant materials designated to be saved, protected and/or undisturbed, that are cut or damaged without prior approval of the Engineer, shall be replaced in kind and size by the Contractor, at no expense to the Owner. If the Engineer agrees that tree replacement is impossible or impractical, the Contractor shall pay the Owner damages of One Thousand Five Hundred Dollars ($1,500.00) per inch of diameter measured four (4) feet from the ground surface.

D. Disposal of waste/surplus materials may involve securing permits, licenses, or approvals, which may vary according to the type of material to be disposed of prior to the start of construction. The Contractor shall apply for these, as they may be required by the various governing agencies and pay all required fees. The Contractor shall have sole responsibility for the legal disposal of all waste surplus material of this project. The Contractor shall be responsible for any and all fines due to any illegal activity with regards to the disposal of waste/surplus materials.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. All graded areas, and all areas within the Limit of Work Line on which proposed work is to be installed, shall be cleared and grubbed as may be needed and as indicated on the drawings.

B. The Contractor shall be careful to note any areas that may be designated on the drawings to receive only selective clearing and thinning.

3.02 CLEARING, GRUBBING, TREE AND STUMP REMOVAL

A. Trees

1. Preparation of the site shall include the complete removal of all trees within the Limit of Work Line, except in those areas where selective clearing and thinning is required. Any trees within the Limit of Work Line not to be removed shall be protected from damage during clearing and construction operations by barriers or by such other methods as conditions may require. No construction materials or debris shall be stored or stockpiled, or vehicles parked or operated within the limits of the branch spread of the trees to be saved.

2. Clearing operations shall be performed in a manner which will prevent damage by falling trees to trees left standing or to structures under construction, and by methods which will provide for the safety of employees and other persons.

3. Limited clearing and thinning shall be performed in areas identified on the drawings, as required or as directed by the Engineer. This work will involve the removal of brush, small trees, dead, damaged and/or diseased trees. The Engineer will tag or otherwise mark and designate trees and brush to be saved. Where branches of trees which are to be saved interfere with the work, limbs and branches shall be trimmed off neatly and cleanly close to the bole of the tree or to main branches. Cut surfaces shall be painted with a tree wound paint. Pruning shall be done in accordance with the National Arborist Association "Pruning Standards for Shade Trees" and only by persons experienced with this work. The Contractor shall legally dispose of all branches and limbs off site.

4. All trees, above a four-inch caliper, which are designated to be removed shall become the property of the Contractor to be disposed of by sale or otherwise, provided that such material shall be removed from the property of the Owner before the completion of the site clearance work. The Owner assumes no responsibility for the protection and safekeeping of such materials. The Contractor shall be responsible for all taxes, if any, incurred in the sale of materials.

B. Grubbing shall consist of the grubbing up, removal and disposal of all stumps, roots larger than 1-1/2 inches in diameter, and matted root formations from the designated areas. All rocks or boulders near the existing surface grade, which may interfere with planned construction operations, shall be removed and disposed of as surplus/waste material, or used as fill, where specifically permitted by the Engineer.

3.03 DISPOSAL OF WASTE MATERIALS

A. Disposal of Cleared and Grubbed Materials

1. If disposal of cleared and grubbed materials by burning is not permitted, they shall be legally disposed of off site by the Contractor.

2. All cleared and grubbed materials may be disposed of by burning, if permitted by federal, state, and local laws and regulations and at the Contractor's option. Burning shall be in compliance with all federal, state, and local laws and regulations relative to the building of fires. Burning shall be done under constant attendance until the fires have fully burned out or have been extinguished. All ashes, debris and unburned matter remaining from the burning operations shall be legally disposed of off site by the Contractor.

B. All waste materials shall be satisfactorily legally disposed of off site by the Contractor.

3.04 SEDIMENT AND EROSION CONTROL

A. The Contractor shall take such actions as may be required to ensure that his construction activities do not interfere with or adversely impact the hydraulic characteristics or aesthetic qualities of any natural or manmade watercourse or drain.

B. The Contractor shall provide acceptable siltation control devices such as haybale sediment control devices or permanent or portable control basins for the settling or filtering of fine sands, silts and clay resulting from rainfall runoff or dewatering operations. Any natural areas or manmade structures which have been affected by siltation or erosion due to construction activities shall be restored to their pre-construction condition by the Contractor at no additional cost to the Owner.

C. For more specific requirements for control of erosion and siltation, refer to SECTION 01140, ENVIRONMENTAL PROTECTION.

END OF SECTION

SECTION 02220

EARTHWORK

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes the furnishing of all labor, materials, tools, equipment, accessories and appurtenances necessary to satisfactorily complete all stripping of topsoil, pre-construction survey of the existing structures, dewatering, excavation of all materials (e.g. soils, rock) as needed to construct the proposed structures shown on the Drawings, settlement monitoring, stockpiling, removal of unsatisfactory materials, backfilling, filling, compaction, and grading not specified elsewhere, and all incidental work pertaining thereto within the limits of the work indicated or required as specified herein.

B. In the design of the Contractor’s temporary earth support and dewatering systems, the Contractor shall take into account the stability of the existing facilities including but not limited to gravity sewers, force mains, and pumping stations.

C. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to, the following:

1. Samples of Materials proposed for use.

2. Materials Brochures

3. Blasting Certification Letter

4. Temporary Earth Support and Control of Water Certification Letter

5. Monitoring plan and results.

C. Submit the following information at the times indicated:

1. For each type of material to be utilized as fill or backfill, the Contractor shall provide the Engineer at the Engineer's designated laboratory with two (2) fifty-pound (50 lb.) bag samples from each proposed source of material a minimum of two (2) weeks prior to first use.

2. For off-site materials, submit the name of each material supplier with specific type and source of each material at least two (2) weeks prior to delivery to the site. Include the results of environmental testing specified herein. Any change in type or source of material during the work requires the written approval of the Engineer.

3. All off-site material brought to the site shall be free of contaminants. The Contractor shall identify the source of the material and be prepared to provide results of environmental testing performed on a representative sample of the material from each source. As a minimum, environmental testing shall include Total Petroleum Hydrocarbons (TPH) by ASTM D3328/EPA Method 8100, Polynuclear Aromatic Hydrocarbons (PAH) by EPA Method 8270, and metals (RCRA 8) by EPA Methods 6010/7471A.

1.05 PRODUCT HANDLING - Not Used

1.06 PROTECTION OF WORK

A. The Contractor shall execute the work so that no damage occurs to adjacent utilities, buildings, structures, roadways, sidewalks, equipment, and properties, or any other installation located in or adjacent to work areas. All construction induced damage shall be repaired by the Contractor to the satisfaction of the Engineer and the governing utility owner at the Contractor's expense. The Contractor shall have on site the necessary manpower, materials and equipment such as pumps, piping, and the like as required to protect and maintain uninterrupted flows in existing utilities during construction.

B. Excavations shall be kept free from water, snow and ice during construction. Bedding and backfill material shall not be placed in water. Water shall not be allowed to rise upon or flow over bedding and backfill material.

C. The Contractor shall maintain all benchmarks, monuments and other reference points and, if disturbed, shall replace them at no additional cost to the Owner.

D. Excavating equipment shall be of such size and type, and used in a manner, that will not damage existing items such as but not limited to paved surfaces, utilities, structures, trees.

E. The finished subgrade shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the finished surfaces are placed. Until the subgrade has been observed by the Engineer, no pavement materials shall be installed thereon.

F. The Contractor shall take whatever steps necessary to prevent catch basins and drain lines from receiving silt and sediment washed from project work areas. The Contractor shall clean out catch basins and drain lines that have not been successfully protected.

1.07 RELATED DOCUMENTS

A. State Building Code

B. ASTM C136 - Method for sieve analysis of fine and coarse aggregates.

C. ASTM D1557 - Test method for moisture-density relations of soils and soil aggregate mixtures using ten pound hammer (10 lb.) and eighteen-inch (18") drop

D. ASTM D6938 - Test method for density of soil and soil-aggregate in place by nuclear methods (shallow depth).

E. ASTM D3017 - Test method for moisture content of soil and soil-aggregate in place by nuclear methods (shallow depth)

F. ASTM D1556 – Test method for density of soil and soil aggregate in place by the sand cone method

G. OSHA Regulations, 29CFR Part 1926 – Excavations, current revisions

1.08 PROJECT CONDITIONS

A. Visit the site to review all details of the work, working conditions and site access and to verify dimensions in the field. Notify the Engineer in writing of any discrepancy before performing any work.

B. Consult official records of existing utilities, both surface and subsurface, and their connection to be fully informed on all existing conditions and limitations as they apply to this work and its relation to other construction work.

C. Notify the Engineer in writing if unexpected subsurface conditions are encountered.

D. Comply with all rules, regulations, laws, permits and ordinances of all authorities having jurisdiction including, but not limited to the Owner and the state where the work is occurring. All labor, materials, equipment and services necessary to make work comply with such requirements shall be provided without additional cost to the Owner.

1.09 SUBSURFACE DATA

A. Review logs of subsurface explorations (i.e. borings, test pits), record of investigations, laboratory test data, and other pertinent data for the site. After obtaining Owner's permission, take whatever additional explorations deemed necessary at no additional cost to the Owner.

B. Exploration logs and geotechnical laboratory data are attached to this specification. Exploration locations are shown on the Drawings.

C. Samples for the borings taken are available for review by the Contractor. The Contractor is encouraged to contact the Owner and make arrangement to visit their storage facility to review these samples.

D. The aforementioned data is for general information and is accurate only at the particular locations and times the subsurface explorations were made. It is the Contractor's responsibility to make interpretations and draw conclusions based on the character of materials to be encountered and the impact on his/her work based on his expert knowledge of the area and of earthwork techniques.

E. By submitting a bid, the Contractor affirms that the site and all conditions affecting the work under this Section have been carefully examined. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions as indicated in the Contract Documents, or obvious from observations at the site.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill materials, meeting the following requirements, shall be used in the areas shown on the drawings or where specified herein. Fill materials may be obtained from either on-site excavations or from off-site sources as appropriate.

2.02 COMMON FILL

A. Common Fill shall be granular material, consisting of hard, sand and gravel with less than thirty-five (35) percent passing the No. 200 sieve, when tested in accordance with ASTM C136 and ASTM C117 and shall be free of organic matter, trash, roots or other deleterious material.

B. Common Fill material shall contain no stone measuring greater in any dimension than two-thirds of the loose lift thickness or twelve (12) inches whichever is smaller. Common fill material shall be capable of forming a firm, stable base when spread and compacted. In addition, the common fill shall be non-plastic (plasticity index zero, defined as liquid limit minus plastic limit). Any materials, excavated from the site, not conforming to this common fill specification, shall be legally disposed of by the Contractor and replaced with approved material, as required, at no additional cost to the Owner. Common Fill shall be used in the following locations:

1. General fill in landscaped areas.

2. At locations shown on the Drawings.

3. Backfill against structures (below the level of the foundation drainage system, where applicable.

2.03 GRAVEL FILL/SAND-GRAVEL FILL

A. Gravel Fill/Sand-Gravel Fill shall consist of hard, durable gravel and sand, free from trash, organic matter and clay, surface coatings, and other deleterious materials.

B. Gravel Fill/Sand-Gravel Fill shall have a maximum stone size of two thirds of the loose lift thickness or four (4) inches whichever is smaller. Gravel fill used for pipe bedding shall have a maximum stone size of two (2) inches. That portion passing the four (4) inch sieve shall meet the following gradation requirements, as determined by ASTM C136 and ASTM C117:

U.S. Sieve Size	Percent Passing
4 inch	100
1/2 inch	50 to 85
No. 4	40 to 75
No. 50	8 to 28
No. 200	0 to 10 *

* If placed within 4 feet of foundation and retaining walls, the percent finer by weight for the No. 200 sieve shall be 0 to 8.

C. Gravel Fill/Sand-Gravel Fill shall be used in the following locations:

1. Below Foundations

2. Slab-on-grade base course layer.

3. Where placed on saturated soil subgrade.

4. Pavement/sidewalk subbase and base course.

5. At locations shown on the Drawings.

2.04 SELECT FILL/GRANULAR FILL

A. Select Fill/Granular Fill shall consist of hard durable sand or sand and gravel, free from trash, organic matter, clay, surface coatings and other deleterious materials.

B. Select Fill/Granular Fill placed between the mid-height of a pipe and twelve (12) inches above a pipe shall have a maximum stone size of four (4) inches. Select fill used for other purposes shall have a maximum stone size of two thirds of the loose lift thickness and that portion passing the four (4) inch sieve shall meet the following gradation requirements, as determined by ASTM C136 and ASTM C117:

U.S. Sieve Size	Percent Passing
2/3 Loose Lift Thickness*	100
No. 10	30 to 100
No. 40	0 to 70
No. 200	0 to 15**

* 8-inch maximum or 4-inch maximum when used as backfill within utility excavations

** If placed during wet weather or within 4 feet of foundation and retaining walls, the percent finer by weight for the No. 200 sieve shall be 0 to 8.

C. Select Fill/Granular Fill shall be used in the following locations:

1. Below slab base course layer.

2. Below foundations.

3. Below pavement/sidewalk subbase and base course.

4. Utility excavations.

5. At locations shown on the Drawings.

2.05 “SEMI-IMPERVIOUS” FILL

A. “Semi-Impervious” Fill: Inorganic soil free of loam, ice and snow, roots, sod, rubbish, and other deleterious or organic material.

B. “Semi-Impervious” Fill shall have a compacted in-place hydraulic conductivity of ten to the minus six (10-6) centimeter per second (cm/sec) or less.

C. “Semi-Impervious” Fill shall be used in the following locations:

1. As the “Semi-Impervious” Fill layer in limited thickness behind foundation walls and above the zone of “free-draining” (e.g. Gravel Fill) backfill overlying foundation drains, as shown on the Drawings.

2. At locations shown on the Drawings.

2.06 CRUSHED STONE (3/4-INCH)

A. Crushed stone shall consist of clean, crushed, non-porous rock, or crushed gravel, uniformly blended.

B. Crushed stone shall meet the following gradation requirement as determined by ASTM C136 and ASTM C117.

U.S. Sieve Size	Percent Passing
1 inch	100
3/4 inch	90 to 100
1/2 inch	20 to 55
3/8 inch	0 to 15
No. 4	0 to 5
No. 10	0 to2

C. Crushed Stone (3/4-inch) shall be wrapped in non-woven filter fabric and used in the following locations:

1. Around perforated drain lines.

2. Backfill behind walls in confined areas.

3. Where placed on saturated soil subgrade.

4. As an alternate to Gravel Fill for slab base course.

5. As an alternate to Gravel Fill for pavement/sidewalk subbase and base course.

6. At locations shown on the Drawings.

2.07 GEOTEXTILE FABRIC

A. Non-Woven Geotextile Fabric: Filter fabric shall be Mirafi 140N, Carthage Mills FX-40HS, Amoco 4546 or approved equivalent.

2.08 REUSE OF EXCAVATED MATERIAL

A. Excavated materials meeting the gradation limits for fill contained herein, may be segregated and reused as accepted by the Engineer. It is not anticipated, however, that onsite materials will conform to the specified gradation requirements for Gravel Fill or Crushed Stone. It is anticipated, that some but not all of onsite materials will conform to the specified gradation requirements for Select Fill/Granular Fill, Semi-Impermeable Fill and Common Fill.

PART 3 EXECUTION

3.01 PREPARATION

A. Stripping

1. Prior to any excavation, filling, or grading operations, all topsoil and subsoil or similar organic soils found within the Limit of Work line shall be stripped to their full depth in the area of all structures and in all areas required to be filled, excavated or graded.

2. Stripped materials suitable for re-use as loam shall be stockpiled. Stockpiles shall be kept separate and not mixed with other materials. Excess stripped materials and unacceptable materials shall be legally disposed of off-site by the Contractor unless otherwise specified.

B. Pavement Cutting

1. Where excavations are to be made in paved or surface treated areas, the pavement shall be cut with a pavement saw or wheel cutter prior to excavation unless otherwise noted.

2. In areas where the trench width is greater than the original cut, the pavement shall be re-cut prior to paving.

3.02 PROTECTION OF ADJACENT WORK

A. Protect all adjacent structures which may be damaged by excavation work, including buried structures, service utilities and pipe chases. All construction induced damage shall be repaired by the Contractor at no additional expense to the Owner.

B. Grade excavation top perimeter to prevent surface water run-off into excavation.

3.03 EXCAVATION

A. General

1. Excavation shall consist of the removal of soil, rock, and other materials to the limits shown on the drawings, specified herein, and as required to provide firm bearing. No structures, pavements, utilities or fill materials of any kind shall be placed in, or upon excavated areas until such areas have been observed by the Engineer.

2. Excavated materials meeting the requirements for the various fill materials specified herein shall be stockpiled for reuse. Unsuitable or Excess suitable materials shall be legally disposed of off-site by the Contractor unless otherwise specified.

3. Excavation shall be to the limits as necessary to install foundations, utilities, pavement or other facilities and structures unless otherwise specified. Excavation of unsuitable material beyond the limits necessary shall only be performed as authorized by the Engineer.

4. The proposed contour lines and spot grades shown on the drawings are finish elevations. Excavation to subgrade shall be the distance below these elevations as may be required by the size and thickness of pavements, structures, utilities and surface treatments as shown on the drawings, details and sections; to remove rock/bedrock from below the proposed structures and/or utilities, to place bedding materials below structures and/or utilities; to remove unsuitable bearing materials as indicated herein and/or on the Project Documents; to provide undisturbed stable subgrades and/or construct working mats; or as specified herein.

5. Over-excavation beyond the specified or detailed limits shall be backfilled and properly compacted by the Contractor and at no additional cost to the Owner.

6. Excavating equipment shall be of such size and type, and operated in a manner, that will not damage items such as, but not limited to, existing paved surfaces, utilities, structures and trees.

7. The Contractor shall, at his own expense, be responsible to make excavations under guy wires, alongside of poles, buildings, and other objects as necessary to complete the work. This may require the Contractor to perform hand excavation. The Contractor has the full responsibility for this work for which there shall be no special compensation unless otherwise noted herein. The relocation of utility poles, and the like, shall be done at the Contractor's expense.

8. The Contractor is advised that soils at the site are fine-grained, poor-draining, and susceptible to loss of strength when disturbed, which could result in an unstable subgrade for foundations and temporary construction equipment and unstable excavation slopes. Contractor shall design and implement construction measures to protect subgrades from disturbance and maintain stable slopes. Such measures could include excavation with smooth-faced bucket, placement of geotextile fabric and crushed stone working mat, mud mats, or other appropriate subgrade and slope stabilization measures. Measures to create and maintain stable subgrades and slopes shall be considered part of this Work, and shall be provided at no additional cost to the Owner.

B. Trench Excavation

1. Trench excavation shall consist of the removal of all materials encountered. Excavations shall be made to accommodate the elevation, depth of cover, or detail shown on the drawings or specified. Trench widths shall be kept to the minimum practicable but shall be at least three (3) feet wide or two (2) feet plus the diameter of the pipe, whichever is greater. The bottom of the trenches shall be firm and free of water and shall be accurately graded and shaped to allow placement of required bedding beneath the bottom of all barrels, bells or couplings of all pipes installed.

2. Design criteria require that pipe be laid in trench conditions, therefore trenches for utilities in fill areas shall be excavated after all fill materials have been placed, spread and compacted to an elevation at least twelve (12) inches above the top of the proposed utility. This requirement is necessary to fulfill design criteria and should not be construed as a dictation of the Contractor's means and methods of construction.

3. If, through the Contractor's error, the excavations are carried beyond the specified limits, or if inadequate dewatering causes softening of the subgrade which necessitates removal, backfill shall be with gravel fill, placed and compacted as specified hereinafter under Trench Backfilling. Backfill shall be performed at no additional cost to the Owner.

4. When trenching occurs around trees to remain, the tree roots shall not be cut but rather, the trench shall be tunneled under or around the roots by careful hand digging and without injury to the roots.

5. The Contractor shall excavate to provide a minimum cover over the top of pipe and fittings of 5 feet below finished grade unless otherwise shown. For pipes laid within a slope which rises above the adjacent roadway, the top of pipe and fittings shall be 5 feet below the top of the adjacent roadway.

C. Foundation Excavation

1. Excavations shall be carried to the grade lines as indicated or as may be required to permit the finished floors (including footings, slabs, mats as shown on the Drawings) or surfaces to be constructed at the proper elevations and on firm bearing materials. This includes excavation for all pipe channels, sumps, or other features which extend below the bottom of the foundation or slabs.

D. Excavation in Graded Areas

1. Excavation in graded areas shall be performed as necessary to bring such areas to proper subgrade or finish grade. Subgrade for grass areas shall be a minimum of six (6) inches below finish grade unless otherwise specified.

E. Rock and Boulder Excavation

1. General

a. Rock excavation shall include the excavation, removal and disposal of solid rock and all boulders one (1) cubic yard or more in volume which require blasting or drilling and splitting. Boulders or other materials of less than one (1) cubic yard in volume will not be considered rock excavation.

b. Blasts shall be covered to prevent scattering of material and all adjacent property shall be suitably protected. Explosives shall be transported, handled and stored in a safe manner and in compliance with all state and local regulations. Charges shall not be so large as to shake, loosen or endanger adjacent structures or their contents or to do harm to their occupants. Responsibility for damage to persons or property shall rest solely with the Contractor. Only personnel qualified in the use of explosives shall be employed for blasting.

c. The Contractor is responsible for obtaining all necessary permits at no additional cost to the Owner.

d. Where boulders are on the sides of or in the bottom of excavations, they shall be wholly or partially removed at a minimum to the limits as specified and/or as determined by the Engineer. In removing boulders lodged in the sides of the excavations, the Contractor shall not disturb or undermine adjacent pavement or structures. Pavement surfaces damaged beyond reasonable limits as determined by the Engineer, shall be repaired by the Contractor at no additional cost to the Owner. In general, boulders or rock fragments which extend under paved surfaces shall be removed by blasting or mechanical splitting.

e. Depressions below the required grade resulting from the removal of boulders and rock fragments shall be refilled with compacted Gravel Fill and/or Granular Fill/Select Fill, as required by the Construction Documents, at no additional cost to the Owner.

f. Rock/bedrock shall be removed to at least 12 inches below and to the sides of the proposed structures (e.g. foundations, slabs, mats, foundation drains, etc.) and replaced by compacted Gravel Fill or Granular Fill Structural Fill at no additional cost to the Owner.

2. Reference Codes and Specifications - As a minimum, the Contractor shall comply with the provisions of the following Codes and Standards, except as otherwise noted:

a. Associated General Contractors of America, Inc. - "Manual of Accident Prevention in Construction".

b. National Fire Protection Association (NFPA) - 495 Code for the Manufacture, Transportation, Storage and Use of Explosive Materials.

c. Occupational Safety and Health Act of 1970 (Public Law 91-596 of the United States, 29 USC Section 651 et seq.).

d. Applicable provisions of local laws and ordinances, and any requirements of the Chief of the Fire Department of the Owner.

e. In case of conflict between regulations or between regulations and specifications, the Contractor shall comply with the strictest applicable codes, regulations, or specifications.

3. Quality Assurance

a. Blasting shall be performed by a contractor specializing in explosives for disintegration of subsurface rock with a minimum of five (5) years documented experience.

b. Pre-blast surveys shall be performed by personnel experienced in performing such surveys.

4. Pre-blast Survey

a. Prior to the start of blasting, the Contractor, or his/her authorized representative, shall perform pre-blast surveys of any structure within 300 feet of the blasting area. The survey shall also extend to any other structures as may be affected by the construction operations.

b. The pre-blast survey shall consist of a narrated videotape or still photographs accompanied by written narrative. Two copies of the surveys shall be provided to the Engineer.

5. Project Conditions

a. Protect nearby structures from damage. All construction induced damage shall be repaired by the Contractor at no additional expense to the Owner.

b. Perform blasting work only during the hours permitted by Noise Control Ordinances of the Owner.

c. Blasting shall be executed only by personnel having required state and local licenses for blasting and for storage and transport of explosives.

d. Limit peak particle velocity of blast induced motion to less than that two hundred (200) feet from the blast area, or at the property line. Limit instantaneous overpressure from blasting operations to 0.010 pounds per square inch, measured on the nearest structure, or two hundred (200) feet from the blast area, or at the property line, whichever is closer.

e. Protect new concrete:

(1) Do not blast within twenty-five (25) feet of concrete less than five (5) days old.

(2) At distances greater than twenty five (25) feet, limit peak particle velocity from blast to less than one (1) inch per second (ips) at concrete less than three (3) days old, less than two (2) ips at concrete less than seven (7) days old, and less than three (3) ips at concrete greater than seven (7) days old.

6. Project Record Documents

a. The Contractor shall complete, maintain, and submit permanent blast reports, including logs of all blasts. Prior to detonating the blast, a preliminary blast report shall be provided to the Engineer for review. Final reports shall be provided to the Engineer in a timely manner, but in no case more than two (2) working days following each blast. The records shall include the following information:

(1) Date, exact firing time, and limits of blast by elevation and location

(2) Name of person in responsible charge; blasting permit number.

(3) A log of each borehole drilled (maintained by driller) indicating the depth to unusual joint or seam conditions encountered in the rock, problem zones, changes in penetration rate, and other indications of joints or open seams.

(4) Type and strength of explosives, blasting caps, and distribution of delay periods used.

(5) Total explosive loadings per round and per group of delays.

(6) On a diagram of the approved test pattern, indicate any holes not drilled, drilled but not loaded, changes in spacing, or changes in pattern of delays or in loading of holes.

(7) Prevailing weather conditions, including direction and approximate velocity of wind, atmospheric temperature, relative humidity, and cloud conditions at the time of blast.

(8) Comments by blasters in charge regarding any misfires, unusual results, or effects.

(9) An evaluation of the blast indicating fractures, areas of significant overbreak, and any recommended adjustments for the next blast.

(10) Results of vibration and over-pressure monitoring.

(11) Signature and title of person making record entries.

(12) Copies of the blast reports shall be made available for review by the Engineer and an authorized representatives of the Owner.

b. Submit summary of complaints.

7. Complaints

a. Report all blasting complaints to the Engineer within twenty four (24) hours of receipt thereof and provide details.

b. Immediately notify the Engineer, throughout the statutory period of liability, of any formal claims or demands made by attorneys on behalf of claimants or of serving of any notice, summons, subpoena, or other legal documents incidental to litigation, and of any out-of-court settlement or court verdict resulting from litigation.

c. When settlement of a claim is made, furnish the Engineer with a copy of the release of claim by the claimant.

d. Immediately notify the Engineer of any investigations, hearings, or orders received from any Governmental agency, board, or body claiming to have authority to regulate blasting operations.

8. Indemnity

a. Notwithstanding full compliance with these specifications, and successful limitation to maximum peak particle velocities and air-blast overpressure as specified herein, the Contractor shall be solely responsible for any damage, direct, indirect, or consequential, arising from blasting and shall defend and hold the Engineer, and their consultants harmless from any cost, liens, charges, claims, or suits, including the costs of defense, arising from such damage, real or alleged.

b. Observation of the blasting operation (including vibration monitoring in the field during blasting) by the Engineer shall not relieve the Contractor of total responsibility for the accuracy, adequacy, and safety of the blasting, exercising proper supervision and field judgment, and producing the results within the blasting limits required by these Specifications.

9. Materials

a. Explosives: Type recommended by explosives firm and in conformance with NFPA 495. However, powder explosive shall not be permitted. Use only explosive cartridges.

b. Delay Devices: Type recommended by explosives firm.

c. Blasting Mat Materials: Type recommended by explosives firm.

10. Blasting Preparation

    a. Identify required lines, levels, contours, and datum. Locate, identify and protect utilities that remain from damage.

    b. Perform preconstruction survey of adjoining structures.

    c. Provide certificate of suitable insurance coverage.

    d. All rock blasting shall be well covered with heavy mats or timbers chained together and the Contractor shall take great care to do no damage to existing structures, utility lines and trees to remain. Fly rock and debris shall not escape the blast area. Any damage caused by the work of this Contractor shall be repaired to the full satisfaction of the Engineer at no additional cost to the Owner.

11. Rock Removal by Explosives Methods

    a. Advise owners of the abutting properties to the Project Site in writing prior to setting up seismographs. Describe blasting and seismic operations.

    b. Provide vibration and air overpressure monitoring during progress of blasting operations at t least at two (2) locations for each blast. One location shall be at the nearest structure to the blast. Provide monitoring results to the Engineer within twenty four (24) hours of performing each blast. Inform the Engineer and Owner immediately if vibrations or air overpressure exceed the limits specified herein.

    c. Use controlled blasting techniques to reduce over break to a minimum and keep vibrations and overpressure within specified limits.

    d. Disintegrate rock and remove from excavation.

    e. Cut away rock at excavation bottom to form subgrades as required by the Project Documents.

    f. Remove shattered layers to provide sound and un-shattered base below foundations at elevations indicated on the Project Documents.

    g. Correct unauthorized rock removal or over break in accordance with the Project Documents, at the direction of the Engineer.

    h. Perform at least three (3) small charge test blasts prior to commencement of production blasting. The purpose is to establish local ground-borne vibration and airborne overpressure propagation characteristics and anomalies to aid in determination of efficient charges that will not cause the vibration and overpressure limits to be exceeded. Coordinate scheduling of each test blast with the Engineer.

12. Field Quality Control

    a. Provide for visual inspection of bearing surfaces and cavities formed by removed rock.

    b. Blasting may be additionally monitored for vibration and air overpressure by the Geotechnical Engineer.

    c. Coordinate all blasts with the Geotechnical Engineer.

    d. When vibrations or noise exceed specified limits, reduce size of loads, use additional millisecond delays, or take other appropriate measures as necessary to satisfy vibration and overpressure requirements.

F. Excavation of Unsuitable Foundation Materials Below Trench Grade and/or Subgrade

1. Structures - The existing fill and buried topsoil/organic soils are considered unsuitable foundation bearing materials and shall be removed from below the zone of influence of proposed structures (i.e. footings, slabs, and mats). Lateral limits of this excavation are defined by a 1 horizontal to 1 vertical (1H:1V) line sloping downward and outward from 2 feet outside the bottom edges of all foundations, slabs and/or mats, down to undisturbed natural alluvial soil deposits. Over-excavation extending below the bottoms of the proposed silo foundation and phosphorous treatment building's ramps and stairwells shall be anticipated to remove existing fill and/or buried topsoil/organics.

2. Utilities - Existing soils, which are considered unsuitable foundation materials by the Engineer, shall be removed to the limits directed by the Engineer within 1H:1V lines sloping downward and outward to top of the suitable bearing soils. For pipelines, the horizontal limits are defined as two feet plus the diameter of the pipe or a minimum total width of three feet whichever is larger unless otherwise directed or shown. The horizontal limits are defined as two feet outside the outside face of the manhole or catch basin base.

3. The exposed subgrade shall be compacted and the area backfilled with Gravel Fill or Granular Fill, placed in controlled lifts and compacted to the requirements of this section. The Engineer shall be present during the excavation of all unsuitable soils in order to permit verification of the limits of and volume of material removed.

G. Experimental Excavation

1. The Contractor shall make excavations at locations authorized by the Engineer, for the purpose of confirming the location and depth of existing utilities or structures.

2. Additional experimental excavations shall be requested by the Contractor to precisely locate utilities and underground structures which may be affected by his work. The Contractor shall backfill the experimental excavations with materials meeting the specification for common fill, unless directed otherwise by the Engineer. Backfill of experimental excavation shall be compacted in accordance with the requirements for Trench Backfilling.

3.04 TEMPORARY EARTH SUPPORT

A. The Contractor shall design, furnish, install and maintain temporary earth support systems, as required, to prevent injury to persons, collapse of the sides of the excavation, and damage, disturbance and settlement of adjacent structures, utilities and property, and to limit unbalanced lateral loads applied to existing nearby structures during excavations. The temporary earth support system shall be of adequate type, size and strength for the conditions encountered and shall be driven to true alignment in a workmanlike manner.

B. Comply with local safety regulations and/or, in the absence thereof, with the provisions of the Occupational Safety and Health Act (OSHA) for trenching and excavation. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state and federal safety regulations. Specifically, the current OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926 should be followed. It is our understanding that these regulations are strictly enforced by OSHA.

C. The Contractor's "responsible person", as defined in 29 CFR Part 1926, shall evaluate the soil exposed in the excavations as part of the Contractor's safety procedures.

D. The Contractor's "responsible person" shall establish a minimum lateral distance from the crest of the slope for all vehicles and spoil piles. Likewise, the Contractor's "responsible person" shall establish protective measures for exposed slope faces.

E. Timber sheeting shall be straight and sound and shall be tongue and grooved where groundwater is encountered. Minimum thickness of timber sheeting shall be a nominal three inches. Timber sheeting is not allowed to remain in place.

F. Steel sheeting shall have a minimum thickness of 3/8 inch. Steel sheeting shall be designed for the conditions encountered and shall be driven tight.

G. Removal and Non-Removal of Excavation Support System

1. Lateral earth support systems shall be left in place unless otherwise approved by the Engineer. Timber sheeting/lagging shall not be allowed, where lateral support is to be left in-place.

2. Sheeting left in place shall be cut off at least one (1) foot above the crown of the pipe. In no case shall the top of sheeting be left in place within five (5) feet of the finished grade.

3. All components of the excavation support system not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of excavation support system components shall be immediately refilled with sand by ramming with tools especially adapted for that purpose, or otherwise as may be directed.

H. The Contractor shall be fully responsible for furnishing, installing, maintaining, reinforcing, removal and non-removal of all lateral earth support system components and shall be fully responsible for all damages, losses and claims involving the use or non-use of excavation support systems despite any orders given or any orders failed to be given by the Engineer. The Contractor shall hold harmless the Engineer and Owner from all damages, losses and claims involving the use or non-use of excavation support systems.

I. The Contractor shall furnish, put in place, and maintain excavation support systems to support the vertical sides of excavations, to minimize any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent buildings, structures, roadways, walkways, and utilities from disturbance, undermining or other damage.

J. The Contractor shall engage an independent Registered Professional Engineer (P.E.), registered in the State of Massachusetts, with experience in the design of temporary earth support to design the temporary earth support systems. The Contractor shall submit a notarized letter, signed and stamped by his/her registered P.E., to the Engineer stating that (refer to attached sample letter):

1. The earth support systems, slopes and dewatering systems have been designed by him/her in accordance with applicable state and federal regulations and with the standard of care; and

2. He/she has at least five (5) years experience in design of earth support systems similar in extent and scope as required for this project.

K. Care shall be taken to prevent voids outside of the excavation support system, but if voids are formed, they shall be immediately filled and rammed.

L. The Contractor shall remain solely responsible for the adequacy and safety of design, materials and methods used to install and maintain the lateral earth support systems. The Owner, Engineer and the Owner/Engineer's other Consultants are not responsible for safety of the Work.

M. The independent professional engineer engaged by the Contractor to design of the temporary earth support systems shall visit the site at least twice during the construction of each earth support system in order to verify that construction is consistent with the requirements of their design. The independent professional engineer shall prepare a written site visit report for each visit and submit such reports directly to the ENGINEER. The written reports shall include a summary of the work completed to date, a summary of the ongoing activities, a summary of corrective actions required, if any, and for completed earth support systems a certification of compliance with the requirements of their design.

3.05 CONTROL OF WATER

A. The Contractor shall evaluate the impact of the anticipated subsurface soil and groundwater conditions on his proposed method of excavation, temporary earth support, and dewatering and other operations. The Contractor shall provide deep wells, well points, or any other facilities to control groundwater and surface water in order to permit work to be performed under dry and stable conditions. The Contractor shall provide any facilities required to remove subsurface water from the construction area in advance of excavation.

B. Dewatering shall be performed as necessary to maintain water levels at least two (2) feet below subgrades levels, allow observation of the subgrade, and to maintain a stable bottom. Dewatering shall continue until all Work below groundwater level has been completed or otherwise stabilized against uplift or other disturbance. Pumping shall be continuous where required to protect the Work and to maintain satisfactory progress. Where necessary, redundant systems such as pumps and power sources shall be provided to protect the work. All dewatering wells shall be backfilled upon completion of the work.

C. The Contractor shall engage a Registered Professional Engineer in the State where the Proejct is located with experience in the design of dewatering system consisting of well points; deep wells; or similar systems in order to pre-drain the area prior to excavation below the groundwater level. The Contractor shall submit a notarized letter, signed and stamped by his/her registered P.E., to the Engineer stating that (refer to attached sample letter):

1. The dewatering system has been designed by him/her in accordance with applicable state and federal regulations and with the standard of care; and

2. He/she has at least ten (10) years of experience in design of dewatering systems similar in extent and scope as required for this project.

D. The Contractor shall control all surface water within the work area. Excavations shall be protected from flooding by surface water by use of berms, ditches or other suitable means deemed appropriate by the Contractor.

E. The Contractor shall pay special attention to areas where difficult soil and groundwater conditions are anticipated and shall evaluate the subsurface conditions in these areas from the geotechnical data provided within this document or by other means. Due of fine-grained nature of the onsite soils, it may take significant time to satisfactorily dewater soils. In addition, these soils are interbedded with highly permeable soils (e.g. sand) in some areas that could yield significant amounts of water. The Contractor shall allow sufficient time for dewatering prior to start of any excavation and/or depressurizing of the alluvial soils deposits. Depressurize the alluvial soils deposits by use of deep dewatering wells/trenches and other means as necessary in the area of each proposed structure before start of any excavation

F. All pipelines and structures not stable against uplift during construction or prior to completion of installation shall be thoroughly braced or otherwise protected.

G. The Contractor shall mitigate potential migration of fines and shall dewater in a manner which does not cause loss of ground or disturbance to the bearing soil or soil supporting the existing and/or newly constructed structures.

H. Discharge of pumped groundwater shall be to on-site sedimentation basins. The Contractor shall provide all necessary piping, sedimentation basins and treatment of groundwater (if required). The Contractor is responsible for obtaining all permits required for dewatering and performing all sampling and testing required by the permit(s). The Contractor shall operate pumps and sedimentation basins in such a manner as to comply with the requirements of discharge permits. If necessary, the Contractor shall provide additional tanks and/or other mitigating measures at no cost to the Owner.

I. Dewatering efforts must satisfy requirements of local, state and federal regulations.

3.06 GROUNDWATER LEVEL OBSERVATIONS

A. The Contractor shall install a minimum of four (4) groundwater level observation wells, in the area of the proposed structure before the start of any excavations for structures at the site.

B. These wells will be monitored by the Engineer to determine the effectiveness of the dewatering systems at the site. No excavation shall be performed until the area has been predrained and the water levels within the excavation are at least two (2) foot below the deepest bottom of excavation. The location of the observations wells may be adjusted by the Engineer if they judge that nearby dewatering wells will disproportionately affect the water levels in the observation wells.

C. Observation wells shall be installed in 4-inch minimum diameter cased drill holes. Drill holes shall be advanced deep enough to install all wells a minimum of ten (10) feet below the bottom of the deepest excavation. This includes over-excavations required to remove potential soft/disturbed soils and construct a working mat (and the structures' bedding materials) at the excavation subgrades.

D. Observation wells shall consist of 2-inch I.D., Schedule 40 PVC solid riser pipe with approximately three (3) rows of one hundred of an inch wide (0.01") slots at twenty-five hundredths inches (0.25") between slots, and spanning the entire depth of excavation below the water table. The riser pipe shall be solid two inch (2") diameter, Schedule 40 threaded end PVC pipe. A solid, one-foot (1') long silt trap shall be provided at the bottom of the well. The top of the riser shall be cut off and capped with a vented PVC top cap. No protective casing is required.

1. Observation wells shall be inserted in the previously drilled boreholes which have been flushed with clean water. The bottom of the drill casing shall be at the proposed bottom of the screen prior to insertion of the screen in the hole.

2. Filter sand shall conform to ASTM C-788-89, Standard Specification for Standard Sand, for 20-30 sand, and shall be graded as follows:

U.S. Sieve Size	Percent Passing by Weight
No. 16	100
No. 30	96 to 100
No. 40	65 to 75
No. 50	20 to 30
No. 100	0 to 4

3. Bentonite pellets used to provide seals shall be Enviroplug Medium, as manufactured by Wyo-Ben, Inc., Billings, Montana, or Holeplug, as manufactured by Baroid Division, Petroleum Services, Inc., Houston, Texas, or approved equivalent

4. The top 2 feet of the hole shall be sealed with native material and mounded to prevent water from entering the ground adjacent to the riser pipe.

E. The Contractor shall not reduce the capacity of the dewatering system by removing or shutting off dewatering wells. The dewatering system shall be kept in operation on a full-time basis until the structure and backfill has been placed to at least the level of the natural groundwater table.

F. Protect the observation wells from damage during construction. Damaged observation wells shall be replaced within forty eight (48) hours with an equivalent well in the same area or in an area selected by the Engineer.

G. Remove/backfill monitoring well with grout at the completion of the Work to the satisfaction of the Engineer at no additional cost.

3.07 STRUCTURAL AND EMBANKMENT FILLS

A. General

1. Unless otherwise specified or shown, all fill placed beneath structures shall meet the material requirements of Gravel Fill or Granular Fill/Select Fill, and placed and compacted to the requirements specified herein. In fill areas, the "limits of a structure" are defined by the same criteria used for the excavation of unsuitable foundation material below subgrade included under the excavation paragraphs of these specifications.

2. Unless otherwise specified or shown, all embankment fill material obtained from on-site sources shall meet the material, placement, and compaction requirements for Common Fill. When embankment fill material is obtained from off-site borrow sources, it shall meet the material, placement, and compaction requirements for Select Fill.

B. Subgrade Preparation

1. After completion of the necessary excavation and/or stripping operations, the surface shall be smoothed to present a surface free of ruts, holes, sharp ridges, or other uneven features. The surface shall be graded to prevent ponding of surface waters within the subgrade area, and shall include the installation of suitable ditches and sumps where necessary.

2. The entire subgrade shall be compacted to reconsolidate to its original density all soil material loosened during the excavation, stripping, and smoothing operations.

3. Subgrade preparation for foundations (e.g. footings, mats), slabs (e.g. building slabs) shall be conducted in such a way as to minimize disturbance of the subgrade, particularly where fine-grained soils are encountered at subgrade level. Care must be taken to slope all working surfaces to facilitate and control surface water. The fine-grained nature of the soils makes them susceptible to disturbance by construction equipment and activities.

4. After excavation to subgrade level and/or removal of fill and topsoil/subsoil within the proposed structures, proof-compact coarse-grained granular soils (e.g. soils with high percentages of sand and gravel) subgrades with at least six passes of a vibratory drum roller with a minimum static drum weight of 1,000 pounds (static load). Overexcavate any weak or soft spots identified during proof-compaction and replace with compacted Granular Fill or Gravel Fill. Appropriate dewatering/surface water control procedures shall be implemented prior to performing final excavation to subgrade and proof-compaction. Perform proof-compaction at the present of the Owner’s Engineer.

5. Where foundation subgrades consist of silty, moist soils, the final 18 inches of excavation shall be performed with a smooth-edged blade attached to the bucket of the excavator or, alternatively, hand shovel loose, disturbed material such that the subgrade is essentially undisturbed natural soils. Proof-compaction shall be performed using static methods or may be waived at the discretion of the Geotechnical Engineer. Construction operations shall be planned to mitigate disturbance to the final subgrade.

6. To help protect subgrades from disturbance, implement measures such as placement of Gravel Fill and/or Crushed Stone (placed over non-woven Filter Fabric) working mats, or mud mats. Disturbed subgrades shall be overexcavated to firm and stable ground and replaced by compacted Crushed Stone placed over non-woven Filter Fabric or Gravel Fill at no additional cost to the Owner.

7. No fill or concrete shall be placed until the surface against which it is to be placed has been observed by the Engineer.

C. Fill Placement

1. Fill shall be placed to the lines and grades for each class of material shown on the drawings or specified herein. In general, the deepest fills shall be made first.

2. Fill materials shall be spread in approximately flat layers (horizontal or sloped as required) in such a manner as to obtain layers of relatively uniform thickness without spaces between successively deposited loads. Placing and spreading shall be done in such a manner as to prevent segregation.

3. Fill shall be placed in lifts and in a systematic manner which will provide uniformity throughout the full fill thickness.

4. If the surface becomes rutted or uneven subsequent to compaction, it shall be flattened and leveled before placing the next layer of material. Hauling equipment shall be routed across the fill in such a way as to prevent the formation of ruts or lanes in the compacted fill.

5. Backfill excavations as soon as practical to reduce exposure to weather elements and/or construction traffic. Protect prepared footing and slab subgrades against frost. No fill shall be placed on a frozen subgrade, nor shall any frozen fill material be used.

6. Extra care shall be used when compacting adjacent to walls. Where walls are to be filled on both sides, backfill and compaction shall proceed so that the difference in top of fill on either side of the wall does not exceed 2 feet. Where walls are backfilled on one side, use hand-operated rollers or plate compactors weighing less than 250 pounds within a lateral distance of 5 feet of walls up to 15 feet high, or 10 feet for walls higher than 15 feet unless provisions are implemented to support the walls to resist the loads or they are designed as retaining structures.

D. Compaction

1. In-place compaction testing will be performed in accordance with ASTM D1556 or ASTM D6938. Allow the Geotechnical Engineer sufficient time to make necessary observations and tests.

2. The degree of compaction, referenced to the maximum dry density of the soil as determined in accordance with ASTM D1557, Method C, for fill placed in various areas shall be as follows:

Area	Minimum Degree of Compaction
Below Footings, Slabs, and Mat Foundations	95%
Behind foundation walls and retaining walls	92%
Below pavement/sidewalk subbase and base course	95%
Landscaped areas	90%

3. If field density testing indicates Work does not meet specified requirements, remove Work (or re-compact where appropriate), replace and retest at the expense of the Contractor.

4. The compaction alternatives given below are stated to provide minimum compaction standards only and in no way relieve the Contractor of his obligation to achieve the above-specified degree of compaction by whatever additional effort is necessary:

		Maximum Loose Lift Thickness *		Minimum Number of Passes	
Compaction Method	Maximum Stone Size	Below Structures and Pavement	Less Critical Area	Below Structures and Pavement	Less Critical Area
COMMON FILL, SELECT FILL, GRANULAR FILL, GRAVEL FILL					
Hand-operated vibratory plate or light roller in confined areas	4”	6”	8”	4	4
Hand-operated vibratory drum rollers weighing at least 1,000 lbs. in confined areas	6”	10”	12”	4	4
Light vibratory drum roller Minimum weight at drum 3,000 lbs. Minimum dynamic force 10,000 lbs.	8”	12”	18”	4	4
Medium vibratory drum roller Minimum weight at drum 10,000 lbs. Minimum dynamic force 20,000 lbs.	8”	18”	24”	6	6

*And no more than two-thirds (2/3) loose lift thickness

5. Fill that is too wet for proper compaction shall be diced, harrowed, mixed with drier material or otherwise dried to a proper moisture content for compaction to the required density. If the fill material cannot be dried within 48 hours of placement, it shall be removed and replaced with drier fill at the Contractor's expense.

6. 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.

7. Fill that becomes disturbed after compaction as a result of the Contractor's operations shall be removed and replaced or re-compacted to the specified degree of compaction at the Contractor's expense.

8. Crushed stone shall be compacted with four (4) passes of approved compaction equipment.

E. Maintenance of Fill Surface

1. The surface of the fill shall at all times be kept reasonably smooth and free from humps or hollows. The fill surface shall be pitched in order to ensure drainage during periods of wet weather.

2. Upon suspension of filling operations for any period in excess of twenty-four (24) hours or in wet weather, the surface of the fill shall be rolled smooth to seal it against excessive absorption of moisture and to facilitate runoff. During the suspension of fill operations, every effort shall be made to protect the compacted fill surface to minimize erosion.

3. If placement of fill material is suspended in a freezing weather conditions or anticipated frost conditions, the compacted fill surface shall receive, before suspending operation, frost protections measures. For example, placing several inches of temporary fill material (loose). The temporary fill (including frozen material below it, if deeper frost) shall be removed (or thawed) prior to placing a new lift or compaction of the loose fill.

4. Fill operations shall be suspended during periods of extended wet weather if the material is too wet to be compacted properly. Upon resuming operations, all fill materials which are excessively wet or soft shall be removed from the fill and either stockpiled for reprocessing or disposed of off site. The removal of wet or soft material shall be carried to such depth as is necessary to expose firm materials.

5. Under no circumstances shall ice, snow, or frozen material be incorporated in the fill. In the event that the fill surface becomes frozen during construction, all frozen materials shall be excavated from the fill and wasted before additional material is placed.

3.08 BACKFILLING OF EXCAVATIONS FOR STRUCTURES

A. No backfill whatever shall be placed on or against masonry, or other cast-in-place structures until the masonry has been in place a minimum of seven (7) days, or has been suitably braced.

B. All piping into structures shall have a joint within two (2) feet of the exterior face of the wall.

C. The type and size of compaction equipment used shall not cause excessive surcharge loads on any walls or other structures.

3.09 PIPE BEDDING AND TRENCH BACKFILLING

A. General

1. The requirements for pipe bedding and trench backfilling are described herein and are shown in the drawings, entitled “Typical Trench Section”.

2. Pipe and/or structures shall be placed on specified bedding materials, to provide uniform support and a stable foundation for the pipeline or structure and backfill material. No bedding shall be placed on unstable subgrade soils. An unstable subgrade is defined as a condition of running sand, running silt, quick bottom, or otherwise soft, soupy or spongy bottom. If an unstable condition exists, or develops during the excavation, the Contractor shall excavate, dewater and stabilize the subgrade to the extent necessary to provide a firm stable foundation prior to placing bedding, pipe and/or structures.

3. The height of fill adjacent to structures and pipelines shall be increased at approximately the same rate on all sides to prevent displacement.

B. Trench Bedding

1. Pipelines and appurtenant items of work shall be laid in the bedding material, from the bottom of the excavation to the mid-diameter of the pipe, for the full width of trench. Bedding material shall be compacted to a minimum density of ninety-five (95) percent of the maximum density as determined by ASTM D1557 (Modified Proctor) and shall meet the requirements for gravel fill or crushed stone.

2. The type and thickness of bedding material shall be adjusted based on field conditions, as follows:

   a. Where the bottom of trench is stable and the existing material at trench grade meets the requirements for Gravel Fill, as determined by the Engineer, the Contractor will not be required to excavate six (6) inches below the pipeline for placement of bedding material. Gravel fill or crushed stone bedding material shall be placed and compacted to the mid-diameter of the pipe as specified hereinbefore.

   b. When the subgrade material does not meet the specification for Gravel Fill, the excavation shall be made to a depth of six (6) inches below the bottom of pipe for placement of bedding material.

   c. Where the bottom of the trench excavation is below the groundwater level and pumping of water is done from within the excavation, the Contractor shall use a bedding system which provides a stable working surface which limits the disturbance of the subgrade and prevents migration or washing of fine soils from the subgrade due to the flow of water into the trench. If the subgrade is stable and meets the requirements of gravel fill, excavation for six (6) inches of bedding material is not required.

3. If the Contractor excavates beyond the required limits, the Contractor shall backfill this unauthorized excavation with compacted gravel fill at no additional cost to the Owner. Gravel Fill used to replace unsuitable material or unauthorized excavation shall be compacted to a minimum density of ninety-two (92) percent of the maximum density determined by ASTM D1557, (Modified Proctor).

C. Trench Backfilling

1. Backfill materials, meeting the requirements for Select Fill, shall be installed above the mid diameter of the pipe to twelve (12) inches above the pipe. The Select Fill backfill shall be compacted to a density of at least ninety-two (92) percent of the maximum density as determined by ASTM D1557 (Modified Proctor).

2. Backfill materials placed from twelve (12) inches above the pipe to the bottom of the roadway base course in paved areas or to the bottom of loam shall meet the requirements for Common backfill. Fill shall be placed and compacted so that a density of at least ninety (90) percent of the maximum density is achieved as determined by ASTM D1557 (Modified Proctor). The Contractor shall select his equipment and establish his procedures consistent with the backfill materials being used to achieve the required density. Backfill materials with more than fifteen (15) percent passing the No. 200 sieve shall be placed at a moisture content between two (2) percent dry and three (3) percent wet of the optimum moisture content as determined by ASTM D1557.

3. Puddling or jetting of the backfill materials may be utilized, however, any water used for puddling or jetting shall be secured in sufficient quantity and pressure to obtain the required result and shall be provided by the Contractor at no additional cost to the Owner.

4. All settlement of trench backfill shall be repaired by the Contractor at no additional cost to the Owner. All repairs shall be made with materials meeting the requirements and compacted to the requirements of this section.

5. All surplus material shall be removed and disposed of by the Contractor after trenches have been backfilled. The removal of surplus material, cleaning up of trench surfaces shall closely follow the pipe laying.

6. Where hardened surfaces or roadways, driveways, or walls are dug up or interfered with, special attention shall be given to the backfilling operations before resurfacing.

7. The Contractor shall continually provide street sweeping on roadways, used by his vehicles, in order to reduce dust, siltation, nuisance problems, and to provide safe passage for vehicular and pedestrian traffic.

3.10 FIELD QUALITY CONTROL

A. The Contractor will retain a Geotechnical Engineer, approved by the Engineer, to perform on-site observations and testing during the following phases of the construction operations.

1. Observation during excavation of construction areas, structure subgrade areas, roadway areas, and other controlled fill areas.

2. Observation of all subgrades below unsuitable soils and foundation subgrades prior to placement of compacted backfill or foundations.

3. Observation during placement and compaction of backfill within building/structure subgrade areas, roadway areas, against foundation walls, beneath buried utility areas and other controlled fill areas as appropriate.

4. Laboratory testing and analysis of fill and bedding materials specified.

5. Performing water content, gradation, permeability and compaction tests at a frequency and at locations necessary to evaluate compliance with this Specification. The results of these tests will be submitted to the Contractor on a timely basis so that the Contractor can remedy any deficiencies that may be discovered. Al also be copy of these reports shall also be submitted to the Engineer.

   a. Obtaining groundwater level data from the observation wells.

   b. Monitoring vibrations and over-blast pressures measurements, as requested by the Owner.

B. Placement and compaction of fill within proposed structures, retaining walls, backfill against foundation walls, beneath buried utility areas and beneath paved areas will be observed and tested by the Geotechnical Engineer. At least one (1) field density test will be performed for each five hundred (500) cubic yards of fill and for each lift of fill placed.

C. Test and analysis of fill materials will be performed in accordance with ASTM C146 and ASTM D1557.

D. In-place compaction testing will be performed in accordance with ASTM D6938.

E. Provide the Geotechnical Engineer with free and safe access to Work at all times.

F. The presence of the Engineer or Geotechnical Engineer does not include supervision or direction of the actual Work by the Contractor. Neither the presence of the Engineer or Geotechnical Engineer nor any observation and testing performed by the Geotechnical Engineer, nor any notice or failure to give notice, shall excuse the Contractor from defects in his Work.

G. Any re-testing that must be performed due to non-compliance with this specification shall be at the expense of the Contractor and at no additional expense to the Owner.

H. Contractor to provide Owner’s Field engineer with a minimum of 48 hours notice prior to any work which will require observation and/or testing by the Contractor’s Geotechnical Engineer.

I. The Contractor shall make no claim due to the testing results or testing turn around time of the Geotechnical Engineer which may require the delay of the Contractor’s operations.

J. Contractor shall be responsible for all costs and fees charged by the Geotechnical Engineer as a result of the Contractor’s cancellation or postponement of any activities for which the testing service has been scheduled.

3.11 GRADING

A. General

1. The areas to be graded shall be raked or machine-graded to remove stones and other unsatisfactory material and then shall be compacted as specified. Any depressions which occur during the compaction operation shall be filled with additional suitable material and the surface then regraded and compacted until true to line and grade as required.

2. The work includes all grading required including shaping, trimming, compacting and finishing of the surfaces. The grading of shoulders and sloped areas may be done by machine methods. Up to two (2) inches in ten (10) foot tolerance will be permitted on slopes over two (2) percent, and one (1) inch in ten (10) foot on slopes under two (2) percent provided the slopes are uniform in appearance and without abrupt changes. All ruts shall be eliminated. The maximum deviation from finished grade shall be plus or minus one (1) inch.

3. Grading of subgrades for paved areas shall be finished at the required depth below and parallel to the proposed surface with one-half (1/2) inch in ten (10) foot tolerance.

4. Stones larger than four (4) inches in largest dimension shall not be present in the upper six (6) inches of fill. Grading operations shall be completed after the buildings have been finished, the utilities installed, the site improvements constructed, and all materials, rubbish and debris removed from the site.

B. Finish Grades

1. Finish grades shall be as indicated, and unless otherwise specified, excavations and fills shall be carried to proper subgrade levels below finish grades and contours shown, to allow for finish work.

2. The subgrade for areas on which pavement is to be placed shall be finished to the required depth below and parallel to the proposed pavement surface, after any pipes in the paved area are in place and tested.

3. The grading of the slopes and other areas to be loamed may be done by machine methods and a tolerance will be permitted in slopes as specified above, provided the slopes are uniform in appearance and without abrupt changes.

C. Grading Around Trees

1. Where excavating, filling or grading is required within the branch spread of trees that are to remain, the work shall be performed as noted below:

a. When the existing grade at the tree is below the new finished grade, and fill not exceeding sixteen (16) inches is required, crushed stone shall be placed directly around the tree trunk. The stone shall extend out from the trunk on all sides a minimum of eighteen (18) inches and finish approximately two (2) inches above the finished grade at tree. New earth shall not be left in contact with the trunks of any trees requiring fill.

b. Existing trees in areas where the new finished grade is to be lowered shall have regrading work done by hand to elevation as indicated. Roots as required should be cut cleanly three (3) inches below finished grade and scars covered with tree paint.

3.12 CLEAN-UP

A. Where hardened surfaces or roadways, driveways, or walls are dug up or interfered with, special attention shall be given to the refill and the consolidation before its resurfacing and it shall be done and redone as may be required to make the premises safe at all times and to give the required result.

B. The Contractor shall continually provide street sweeping on roadways used by his vehicles in order to reduce dust, siltation and nuisance problems.

END OF TEXT

SEE ATTACHED

1. Blasting Certification Form

2. Temporary Earth Support and Control of Water Certification Form

Date: _____

To: _____
_____
_____

Subject: Owner Name _____
Project Name _____
Contract No. _____
Blasting Certification

Dear _____:

For the above referenced project, I hereby certify that:

1. To the best of my knowledge, the blast plan has been prepared by a blaster licensed in the State of Massachusetts; and

2. I have reviewed the methods for blasting proposed by the following contractor:

   Name: _____
   Address: _____
   _____
   _____
   Blaster License No.: _____

I have experience in controlled blasting, review of blast submittals, and blast monitoring, and have evaluated the proposed blast plan for conformance with the project specifications and generally employed in this local. The following is a description of the proposed methods to be used during construction:

_____

_____

_____

If you have any questions or comments concerning the information provided, please contact our office.

Very truly yours,

_____
SIGNATURE of REGISTERED PROFESSIONAL ENGINEER

_____
NAME of REGISTERED PROFESSIONAL ENGINEER ENGINEER'S STAMP
(Signed and Dated)

Date: _____

To: _____
_____
_____

Subject: Owner Name _____
Project Name _____
Contract No. _____
Temporary Earth Support and Control of Water Certification

Dear _____:

For the above referenced project, I hereby certify that:

1. I have designed the earth support systems, slopes and dewatering systems in accordance with applicable state and federal regulations and with the standard of care; and

2. I have at least ten (10) years of experience in design of earth support and dewatering systems similar in extent and scope as required for this project.

Name: _____
Address: _____
_____
_____

I have experience in the design of temporary dewatering systems and have evaluated the proposed methods for control of water. I shall design the earth support systems and dewatering systems and shall provide guidance during construction. The following is a description of the proposed methods to be used during construction:

_____

_____

_____

If you have any questions or comments concerning the information provided, please contact our office.

Very truly yours,

_____
SIGNATURE of REGISTERED PROFESSIONAL ENGINEER

_____
NAME of REGISTERED PROFESSIONAL ENGINEER ENGINEER'S STAMP
(Signed and Dated)

END OF SECTION

SECTION 02440

SITE IMPROVEMENTS

PART 1 GENERAL

1.01 SCOPE

A. The work of this section shall include all labor, tools, materials and equipment necessary to install steel bollards and stone maintenance strips with edging and weed barrier as specified herein and as shown on the drawings.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings, brochures and samples shall be submitted for all items to be furnished in accordance with the provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Steel bollards.

2. Material brochures for all edgings and weed barrier.

PART 2 PRODUCTS

2.01 MAINTENANCE STRIP

A. Maintenance strip stone shall conform to the requirements for crushed stone as specified in SECTION 02220, EARTHWORK.

B. Edging for maintenance strips shall be 3/16 inch, by 5-1/2 inch by 16 feet (nominal) black anodized aluminum. Maintenance strips shall be "Clean Line" as manufactured by the Permaloc Corporation, Holland, MI, or equal. Maintenance strips shall be complete with preformed stake pockets every 2 feet per section for 12-inch long aluminum stakes.

C. Pervious weed barrier for the maintenance strips shall be a polypropylene permeable filtration fabric, such as "Soil-Chek" manufactured by Brighton By-Products, Inc., New Brighton, PA, or equal. Weed barrier shall be furnished with required setting pins.

2.02 STEEL BOLLARDS

A. Pipe for the bollards shall be 6-inch O.D. in all locations standard strength galvanized steel conforming to ASTM A120 or A53, except for bollards located around electrical transformers which shall be 4 inch O.D.s standard strength galvanized steel conforming to ASTM A120 or A53. Lengths shall be such as to allow bollards to extend 4-feet above and below grade.

B. Concrete for bollard encasement and for filling the inside of the pipe shall conform to SECTION 03300, CAST-IN-PLACE CONCRETE.

C. Bollards shall be covered with a dome top low-density polyethylene thermoplastic tube having ultra-violet resistance and anti-static properties with a nominal thickness of 0.250 inches. Color shall be OSHA yellow and surface of sleeve shall be smooth with round top. No ribbed or multiple piece systems accepted.

PART 3 EXECUTION

3.01 MAINTENANCE STRIP

A. Stone shall be placed over weed barrier and compacted subgrade and raked level to the desired thickness after steel edging has been installed.

B. Edging shall be installed straight, without dips or deflections and set down from grass or plant beds as shown on the detail.

END OF SECTION

SECTION 02444

CHAIN LINK FENCE AND GATES

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes all labor, materials, tools and equipment necessary to furnish and install chain link fencing and gates as specified herein and as shown on the drawings.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Materials brochures.

2. Fabric and post samples showing size, color, and finish.

3. Drawings showing height of fence, width of gates, sizes and types of materials used for entire fencing system.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. General. Entire chain link fence and gate system shall be vinyl coated galvanized steel. The color of the vinyl coating shall be as selected from manufacturer's samples by the Engineer.

B. Fabric shall be No. 9 gauge, vinyl-coated galvanized steel wire, woven into a 2 inch mesh. Minimum weight of zinc coating shall be 0.30 ounce per square foot. Minimum thickness of PVC coating shall be 0.006 inches and maximum shall be 0.010 inches. PVC coating shall be thermally fused and bonded to a primer, which is thermally cured onto galvanized steel wire. Minimum breaking strength shall be 1,290 pounds. Fabric shall be of the height shown on the Contract Drawings.

C. Barbed wire shall consist of galvanized steel barb wire of the 4-point pattern type composed of two strands of 12-1/2 gauge line wire with 14 gauge barbs spaced on approximately 5 inch centers. Galvanized barbed wire shall conform to ASTM A121, Class 3.

D. The bottom tension wire shall be 7 gauge galvanized wire. Tension wire shall be stretched taut from terminal post to terminal post and securely fastened to each intermediate post 6 inches above the grade line. Tension wire shall be attached to the fence fabric with 11 gauge rings every 24 inches.

E. The chain link fabric shall be securely fastened to all terminal posts using 3/16 inch by 3/4 inch tension bars and heavy 11 gauge tension bands. One band shall be furnished for each foot in the height of fence. The fabric shall be fastened to all intermediate posts with 9 gauge tie wires, spacing not to exceed 14 inches apart. Fabric shall be tied to top rail with 9 gauge tie wires, spacing not to exceed 24 inches. All fabric connectors shall be of galvanized steel conforming to the applicable requirements of ASTM A153.

F. All posts, rails and couplings used in the construction of the fence shall conform to ASTM A120, Schedule 40 all posts, rails, and couplings shall be hot dipped galvanized steel conforming to the applicable requirements of ASTM A123 and of the nominal sizes and weights specified herein. The pipe sizes shall conform to the nominal sizes specified herein and shall be of sufficient length to extend 48 inches into concrete footings. All posts shall be equipped with tops to exclude moisture.

1. The intermediate posts shall be 2-3/8 inches OD pipe (NPS 2), with a weight of 3.65 pounds per linear foot.

2. All end, corner, pull and single leaf gate posts shall be 2-7/8 inches OD pipe (NPS 2-1/2), with a weight of 5.79 pounds per lineal foot.

3. Double leaf gate posts shall be 6-5/8 inches OD round post pipe (NPS 6), with a weight of 18.97 pounds per lineal foot, and shall be equipped with tops designed to exclude moisture.

4. The top and the intermediate rail shall be 1.66 inch OD pipe (NPS 1-1/4), with a weight of 2.27 pounds per lineal foot, provided with couplings approximately every 20 feet. Couplings shall be outside sleeve type at least 7 inches long. The top rail shall pass through the line post tops and form a continuous brace from end to end of each stretch of fence. The top rail shall be securely fastened to the terminal posts by heavy pressed steel brace bands and malleable rail end connections. The line post tops, brace bands and rail end connections shall be galvanized according to ASTM A153.

5. Bracing shall be provided as shown on the drawings.

6. Barbed wire support arms, complete with anchorage to tubular end, corner, and pull posts shall be of galvanized, ASTM A153, pressed steel or malleable iron and shall accommodate three strands of barbed wire on a 45 degree angle outward from the fence line. The barbed wire arms shall be capable of withstanding without failure 200 pounds downward pull at end of arm.

7. Gates shall have truss rods or intermediate braces. Gate fabric shall be attached to gate frame by methods standard with the manufacturer except that welding will not be permitted. Each gate shall be provided with a barbed wire top. Latches shall be arranged for padlocking so that padlock will be accessible from both sides of the gate regardless of the latching arrangement. Gate frames shall be 1.90 inches O.D. galvanized steel pipe (NPS 1-1/2) with a weight of 2.72 pounds per linear foot. Gate fabric and barbed wire shall conform to the requirements specified hereinbefore. All gates shall be equipped with a positive type latching device with a means for padlocking. The double gate shall be equipped with a center plunger, rods, catch and semi-automatic outer catches to secure the leaves in open position. Hinges shall be of pressed steel.

8. All fittings shall be pressed steel in conformance with ASTM F226.

G. Privacy Slats – Privacy slats shall be made from virgin High Density Polyethylene (HDPE) resins with color concentrate and UV inhibitors which are resistant to sun, severe weather, salt water, sand, road dirt, and most environmental pollutants. Privacy slats shall be double wall, bottom lock providing at least 75 percent privacy, and at least 20 year warranty. The color of the privacy slats shall be as selected from manufacturer's samples by the Engineer. Provide spare privacy slats to cover approximately 20 linear feet of fence. Fence slats shall be 4000 Series as manufactured by Fence Screen, Lake Forest, CA or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be made by skilled mechanics experienced in erection of this type of fence. All posts shall be set in concrete foundations to a minimum depth of 48 inches. Diameter of the foundation shall be pipe O.D. plus 12 inches. The foundation shall be a 1-2-4 mixture of concrete and shall be 54 inches deep, minimum. All foundations shall extend approximately 1 inch above grade and shall slope away from the post to provide for proper drainage. Edge of foundation shall be flush with finish grade. Foundations shall be of the shape and sizes shown on the details.

B. Line posts shall be spaced at a maximum of 10 foot intervals. Intermediate rails shall be used to brace end and gate posts to the adjacent line post, and corner posts to the 2 adjacent line posts. Changes in line of 30 degrees or more shall be considered corners.

C. Top rails shall pass through the barbed wire support arms of line posts, forming a continuous brace from end to end of each stretch of fence. Lengths of top of rail shall be jointed by sleeve type couplings. Top rails shall be securely fastened to terminal posts by pressed steel fittings.

D. Chain link fabric shall be placed on the face of the post outside the enclosed areas. The fabric shall be placed approximately two inches above the ground and on a straight grade between posts. The fabric shall be stretched taut and securely fastened to the posts. Fastening to end, gate, and corner posts shall be with stretcher bars and fabric bands spaced at one foot intervals. Rolls of wire fabric shall be joined by weaving a single strand into the ends of the rolls to form a continuous mesh. Chain link fabric shall be fastened to the end bars of the gate frame by stretcher bars and fabric bands, and to the top and bottom bars of the gate frames by tie wires in the same manner as specified for the chain link fabric; or by other standard methods if approved by the Engineer. Vinyl fabric shall be protected from abrasion during shipping, storage and installation. Any abraded areas of fence shall be replaced or protected by painting with a matching PVC paint.

E. Barbed wire support arms shall be installed to slope towards the outside of the fenced area.

F. Fence slats shall be installed in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 02483

PLANTING OPERATIONS

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, equipment, tools, materials and accessories necessary for the complete planting and maintenance of trees, shrubs and ground cover as may be indicated on the drawings, and as specified herein.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. An allowance of $15,000 has been established for furnishing planting materials. Should the actual charges exceed or be less than the amount indicated, the difference will be paid by or returned to the Owner. A paid invoice from the nursery shall be submitted to the Engineer by the Contractor. Refer to SECTION 01020, ALLOWANCES.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals shall include shop drawings including at least the following:

1. Information about the Landscape Contractor or Arborist.

2. Complete list of all materials to be provided showing the details identified herein.

1.05 PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the American Association of Nurserymen’s written recommendations.

B. The Contractor shall maintain all plant material and associated work until final acceptance byte Engineer. Maintenance shall include all pruning, spraying, watering, cultivation and weeding of all planted areas, and the repairing or replacement of all staking, wrapping, mulching and edging materials and any other operations necessary until final acceptance.

C. Water will be furnished by the Contractor. The Contractor shall furnish all necessary hoses and such other accessories as may be required.

1.06 DESIGN CRITERIA

A. Plant material shall be installed by a competent Landscape Contractor or Arborist. Such company shall be certified, or licensed, or affiliated (by membership) with the American Association of Nurserymen or appropriate State organization.

B. The Landscape Contractor or Arborist shall provide references of similar installations.

C. All planting materials shall comply with the American Association of Nurserymen's *American Standard for Nursery Stock* as last amended. All plant names shall be "Standardized Plant Names" as designated by the American Joint Committee on *Horticultural Nomenclature* (1942), as last amended.

D. All plant material shall be inspected and approved by the Engineer prior to planting. Any plant material which does not meet the criteria specified shall be replaced with approved plants at the Contractor's expense.

E. All plants shall meet the requirements specified on the planting plan.

F. All plant material shall be nursery grown and shall be shapely, well-grown, healthy, sound, and free of disease, insect pests, eggs or larvae, and shall have a well developed root system.

G. All trees and shrubs shall be freshly dug; no heeled-in plants or plants from cold storage will be accepted. All plants shall be hardy under climatic conditions similar to those in the locality of the project.

G. All plants shall be handled so that roots will be adequately protected at all times from drying out and from other injury. All plants shall be covered and braced during transportation.

H. Each tree or shrub shall be properly identified by name on legible, weatherproof labels securely attached thereto. Balled and burlapped plants shall have firm, natural balls of soil, the diameter and depth of which shall be sufficient to include the roots. The earth ball shall be adequately wrapped and secured with burlap. Container grown shrubs may be substituted for balled and burlapped shrubs.

I. Container grown plants shall have sufficient roots to hold planting mix in tact after removal from containers without being root bound.

J. When plants of kinds and sizes specified are not available within a reasonable distance, substitutions may be made upon written approval of the Engineer.

K. All plants shall conform to the measurements specified in the plant list and as set forth in American Association of Nurserymen's *American Standard for Nursery Stock* as last amended. Where a size range is given, at least 40 percent of those plants shall be at or above the average for that size range. Exceptions are as follows: Plants larger than specified in the plant list may be used if approved by the Owner, but use of such plants shall not increase the cost to the Owner.

L. Prior to planting, all planting pits will be inspected by the Engineer. Planting pits which do not meet the minimum requirements of the details indicated, shall be reshaped as necessary for approval by the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS FOR GUYING, STAKING AND WRAPPING

A. Stakes - Stakes for supporting trees shall be of the sound wood of uniform size, reasonably free of knots and capable of standing in the ground at least two years. Stakes shall be 2 inches square and shall not be less than 8 feet in length.

B. Wire - Wire for tree bracing and guywire shall be pliable No. 12 gauge galvanized soft steel wire.

C. Hose - Cinch-tie or approved equal hose, if used, shall be two-ply fiber bearing garden hose, not less than 3/4-inch inside diameter.

D. Webbing - Web straps shall be three inches wide as manufactured by Duckbill, or equal and shall be provided with grommets. Hose shall not be allowed.

E. Wrapping Material - Wrapping material shall be first quality, heavy waterproof crepe paper manufactured for this purpose.

2.02 PLANTING SOIL FOR PLANTING PITS AND PLANTING BEDS

A. Loam shall meet the specifications and shall be analyzed as described in SECTION 02485, LOAMING AND SEEDING.

B. Prepared planting mixture shall conform to standard planting practices and the following minimum requirements. Any deviations will be subject to the Engineer's approval.

1. Prepared planting mix shall be 1/3 peat and 2/3 topsoil plus fertilizer/additives as required by the Engineer based on recommendations from testing laboratory reports.

2. Ground cover and shrub planting beds shall have 2-inch layer of peat plus fertilizer/additives as required spread evenly over beds. Peat/additives shall then be cultivated into the top six inches of soil.

C. Peat shall be a commercial grade peat meeting the approval of the Engineer.

D. Fertilizer shall be furnished in manufacturer's standard containers clearly marked with the guaranteed chemical analysis of the product, and shall be of the type and formulation specified by the Engineer. The fertilizer shall conform to local and federal regulations.

E. Limestone shall be standard agricultural ground limestone and shall be delivered in the manufacturer's standard containers with a guaranteed analysis appearing on each container.

F. Mulch shall be chip or chunk bark. Bark shall be fresh and undecayed, clean and free from weeds, leaves, moss, sticks and any other debris, and be of such a texture to resist washing or blowing. No long strips, decayed material nor sawdust will be permitted.

G. Wetting agent shall be non-ionic surfactant consisting of a 50 percent polyoxyethylene ether and 50 percent polyoxyethylene ether chemical type, preferably in a granular form for spreader application.

H. Anti-Transpirant shall be delivered in manufacturer's containers, unopened, with manufacturer's labels attached.

PART 3 EXECUTION

3.01 SEASONS FOR PLANTING

A. Seasons for planting shall be as recommended to the Contractor by the nursery supplying the plant materials, relating to site conditions, plant species, and region where planting is to be done.

B. Planting shall be prohibited in frozen or muddy ground.

C. Approximate planting dates shall be furnished to the Engineer for approval. Material planted out-of-season shall be given extra care and attention by the Contractor. Any out-of-season planting shall be entirely at the Contractor's risk.

3.02 PLANTING OPERATIONS

A. Locations for planting beds, trees and shrubs shall be staked out by the Contractor as shown on the drawings and approved by the Engineer.

B. Plant pits shall be excavated with vertical sides in accordance with the details on the drawings. Plant pits shall not be backfilled with prepared topsoil mixture until they have been approved by the Engineer. If pits are prepared and backfilled with topsoil to grade prior to planting, their location shall be marked and recorded on the plans so that when planting proceeds they can readily be located.

C. Prepared topsoil mixture for backfill in all planting areas shall have all fertilizer/additives, as specified herein, thoroughly incorporated before backfilling.

D. Plants shall be set in center of pits plumb and straight and at such a level that after settlement, the crown of the plant will be at the surrounding finished grade.

E. Backfilling and Watering

1. When balled and burlapped trees are set, topsoil shall be compacted around bases of balls to fill all voids. All burlap, ropes or wires shall be removed from the tops of balls.

2. Planting pit shall be backfilled to its depth. Backfill shall be compacted and pit then filled with water.

3. After two waterings have been completely absorbed, the top half of the pit shall be backfilled and compacted.

4. 1-3/4 pounds of granular wetting agent/100 square foot shall be applied to newly planted area. Wetting agent shall be raked lightly into top inch of soil and then soil raked smooth.

5. A shallow saucer larger than pit shall be formed with a 4-inch ridge of soil to facilitate and contain watering.

6. Immediately after planting, the plant shall be thoroughly watered by completely filling the saucer with water a minimum of two times.

7. Ground cover beds shall be watered to a minimum depth of 4 inches immediately after planting (after application of wetting agent).

F. Tree guying or staking shall be in accordance with the plan detail. Care shall be taken that stakes do not pierce rootballs.

3.03 OBSTRUCTIONS BELOW GROUND

A. In the event that rock, underground construction work or obstructions are encountered in any plant pit excavation work to be done under this contract, alternative locations may be selected by the Engineer.

B. Where locations cannot be changed, the obstruction shall be removed to a depth of not more than 3 feet below grade and no less than 6 inches below bottom of ball or roots when plant is properly set at the required grade.

C. The Contractor shall be paid for the removal of such rock or underground obstructions encountered at the Contract rate per cubic yard, under the appropriate bid item. Limits of payment for excavation in rock fill are 1 foot outside the plant or tree root ball as shown on the drawings.

3.04 UNDERGROUND UTILITIES

A. The Contractor shall be responsible for obtaining plans and locations of utilities and existing underground structures.

3.05 WRAPPING

A. Wrapping of all trees shall be done immediately after they are planted. The trunks of all trees shall be wrapped spirally from the bottom to top with material as specified and shall be adequately secured. The wrapping shall overlap and entirely cover the trunk from the ground to the height of the second branches and shall be neat and snug. Overlap shall be approximately 2 inches apart.

3.06 PRUNING, MULCHING AND WATERING

A. Each tree and shrub shall be pruned in accordance with American Nurserymen Association Standards to preserve the natural character of the plant and in a manner to meet its particular requirements in the landscape plan.

B. All dead wood, suckers and all broken or badly bruised branches shall be removed. Leaders shall not be cut back. Container grown plants shall not be thinned.

C. Pruning shall be done with clean, sharp tools. All cuts are to be made flush and clean.

D. Cuts over 1 inch in diameter shall be painted with an approved tree wound paint. Paint shall cover all exposed cambium as well as other exposed living tissue.

E. Immediately after planting operations are completed, all tree and shrub pits and ground cover beds shall be covered with a uniform 4-inch layer of bark mulch as indicated on the drawings. All remaining planting beds and disturbed areas where no grass is specified shall be mulched with a uniform 4-inch layer of bark mulch which shall extend to edging strips, walks, walls, curbs or other hard surfaces or undisturbed areas.

F. All plant material shall be watered (by flooding) twice during the first 24-hour period after planting.

G. If a problem should arise with a planting, an anti-transparent shall be applied as directed by the Engineer.

3.07 INSPECTION AND ACCEPTANCE

A. Inspection for Provisional Acceptance

1. Upon completion of work, the Contractor shall request an inspection for provisional acceptance by the Engineer. The request shall be received at least 10 days prior to the requested date for provisional inspection.

2. Upon completion of all repairs and replacements by the Contractor as requested by the Engineer, the Engineer shall issue a dated written order of provisional acceptance.

B. All plantings shall be guaranteed by the Contractor for one year. Provisional acceptance will be given by the Engineer following inspection to ensure compliance with the drawings, details and specifications.

C. At the end of the guarantee period, a final inspection of the work shall be made to determine the condition of plant materials. All plants not in a healthy growing condition as determined by the Engineer shall be removed from the site and promptly replaced with plants as specified for the original planting at no expense to the Owner.

D. Plantings replaced at final inspection shall be subject to all requirements in the specifications for the original work including planting, provisional acceptance, guarantee period and final inspection.

END OF SECTION

SECTION 02485

LOAMING AND SEEDING

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes the furnishing of all labor, materials, tools and equipment required to furnish and install loam and seeding in areas as shown on the drawings, unpaved areas disturbed by the Contractor's operations and work, or any cross-country or lawn areas disturbed by the Contractor's operations during the course of construction.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Soil test results and recommendations for liming and fertilizing shall be submitted to the Engineer at least 45 days prior to loaming operations.

2. Certification of variety, proportions and percent germination of species in the seed mixture and percentage of crop seeds, weed seeds, noxious weeds and inert matter shall be submitted to the Engineer at least 45 days prior to loaming and seeding operations.

3. Brochures and samples for woven jute mesh netting and erosion control blanket.

1.05 PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed according to the American Association of Nurserymen’s written recommendations.

1.06 SEASONS FOR PLANTING

A. Seeding shall take place as soon as possible after each loam area has been prepared, in accordance with the recommendations of the seed supplier relating to the site conditions and region where seeding is to be done. Seeding shall be prohibited during windy or inclement weather, or in frozen or muddy ground; in general, conditions for seeding shall meet with the approval of the Engineer. This does not relieve the Contractor of the responsibility of providing a growth that is full and healthy, in the opinion of the Engineer.

PART 2 MATERIALS

2.01 LOAM

A. Testing

1. All loam used in the work of this section of the specifications will be tested and approved for use by the Engineer prior to being spread. Stripped material may be used if approved in accordance with the following requirements. Approved material shall be stockpiled so as not to interfere with the other work and other subgrade or fill materials.

2. All testing shall be done by an independent test laboratory approved by the Engineer. The Contractor shall provide the laboratory with representative soil samples for testing and send test reports directly to the Engineer.

3. Loam shall be tested for the following: pH, buffer pH, soluble salts (expressed in millimhos), available Nitrogen, Phosphorous, exchangeable Potassium, Magnesium, Calcium and Sodium, Cation Exchange Capacity, percent H base saturation, percent Ca base saturation, percent M base saturation, and available Zinc, Manganese, Copper, Iron, humus content and soil type. All nutrient results shall be expressed in parts per million (ppm).

4. Test reports shall also contain specific recommendations as to the exact types and times and rates of application of soil additives and fertilizers based upon the soil test results. These recommendations shall be followed during lawn construction. All Contractors shall note that any and all materials and procedures, with respect to soil additives and fertilizers, contained herein are approximate and are given to assist bidding and that they will be adjusted to comply with test reports.

B. Loam shall be a "fine sandy loam", or a "sandy loam" determined by mechanical analysis and based on the "U.S.D.A. Classification System". It shall be of uniform composition, without mixture of subsoil. It shall be free of stones, lumps, plants and their roots, debris and other extraneous matter over 1 1/2 inches in diameter or excess quantities of smaller pieces of the same materials as determined by the Engineer. It shall not contain toxic substances harmful to plant growth. It shall be obtained from naturally well drained areas which have never been stripped before.

C. No more than 10 percent of loam shall be clay, with organic matter comprising not less than 4 percent, nor more than 20 percent of the total weight per load.

D. Loam shall not be delivered or worked in a frozen or muddy condition.

E. Soluble salts shall not be higher than 75 parts per million.

2.02 LIME

A. Limestone shall be standard commercial ground limestone and shall be applied at a rate to be determined by the Engineer subsequent to the testing of loam; however, the rate shall not exceed 4,000 pounds per acre. Limestone shall not be installed during windy or inclement weather. Limestone in hydro-seeding operations shall be restricted in building areas. Any buildings or structures discolored or damaged from limestone spray shall be the Contractor's responsibility.

B. The Contractor shall take whatever precautions are deemed necessary to prevent damage by distribution of limestone. Any damage incurred by the Contractor's negligence shall be repaired at no additional cost to the project.

2.03 COMMERCIAL FERTILIZER

A. Commercial fertilizer shall be a standard dry granular mixture, delivered in the manufacturer's containers and containing a guaranteed analysis by weight of Nitrogen, Phosphorous and Potash, applied at the rate to be determined by testing.

2.04 SEED

A. Seed shall be fresh, clean, new crop seed. Seed shall be delivered to the work site with each container bearing the dealer's guaranteed analysis. Seed mixes shall be composed substantially as follows with less than 1.5 percent inert matter, not more than one percent crop seed content, and no noxious weed seeds. Seed shall be spread at rates indicated after each mixture.

B. Mowable Grass Seed Mixture (4 pounds/1,000 square feet) shall conform to seed mixture of Massachusetts DPW Standard Specifications Section M6.03.0 for grassplots and islands.

C. Slope and Cross Country Seed Mixture shall conform to seed mixture of Massachusetts Highway Standard Specification Section M6.03.0 for slopes and shoulders.

D. Wildflower Seed Mixture (34 pounds/acre)

1. Wildflower seed mixture shall be eight pounds of Loft's "Pinto" Wildflower Mix, mixed with 26 pounds sheep or hard fescue per acre of seeding.

2. Northeast Mixture by Applewood Seed Co., Arvada, Co., or Northeastern U.S. Wild Flowers by Environmental Seed Producers, Inc., El Monte, CA will be considered at double the manufacturer's recommended rate of application, mixed with sheep or hard fescue as specified above.

E. All topsoil stockpiles shall be stabilized by seeding with annual ryegrass at the rate specified for mowable grass seed mixture. Stockpiles shall be reseeded as necessary to maintain good cover for enrichment and to prevent erosion.

2.05 EROSION CONTROL BLANKET

A. Erosion control blanket shall be “Hi-Velocity Curlex Blanket”, as manufactured by American Excelsior, Co., Arlington, TX, or an approved equal. Erosion control blanket shall be placed on all slopes greater than 3 to 1. Erosion control blanket will be required for the protection of all seed areas or in any area where erosion is a problem.

2.06 WOVEN JUTE MESH NETTING

A. Woven jute mesh netting shall be "Ludlow Soil Saver", as manufactured by the Ludlow Corp., Needham Heights, Massachusetts, or an equal manufactured by Advance Netting Company, Lodi, New Jersey, or "Jute - Net" by Bemis, Inc., St. Louis, Missouri, and shall be placed on all slopes greater than 3 to 1, and all slopes 3 to 1 which are higher than 10 feet. Woven Jute Mesh Netting will only be required for the protection of mowable grassed areas or in any other areas where erosion is a problem.

2.07 STRAW OR HAY

A. Straw or hay for erosion control and moisture retention shall consist of stems or stalks after threshing. Hay shall consist of a mowed, properly cured grass, clover or other acceptable plant. Straw or hay shall be kept in place by stakes, netting, pins or liquid coatings as may be required and as approved by the Engineer.

PART 3 EXECUTION

3.01 SEEDING OPERATIONS

A. Personnel for lawn work shall be familiar with lawn construction and shall be under the constant supervision of a qualified foreman.

B. Preparation for Seeding

1. Preparation of Subgrade. After the Engineer has accepted the subgrade, the Contractor shall do whatever additional grading is necessary to bring the subgrade to a true smooth slope, parallel to finish grade or to the level of adjacent existing loam areas. Subgrade depth for Lawn Areas shall be 6 inches while Subgrade depth for Cross Country Areas shall be 4 inches.

2. The top 3 inches of the subgrade immediately prior to being covered with loam shall be raked or otherwise loosened and shall be free from stones, rock and other foreign materials 3 inches or greater in dimension.

3. Sufficient grade stakes as determined by the Engineer shall be provided to insure correct line and grade of subgrade and of finished grade.

4. Subgrade shall be inspected and approved by Engineer before placing of loam.

5. Loam shall be as specified above, and shall be placed and spread over approved areas to a sufficient depth so that after natural settlement and light rolling for lawn areas, the completed work will conform to the lines, grades and elevations indicated.

6. Finish grading. After loam has been spread, it shall be prepared by scarifying or harrowing and hand raking. All large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter, and stones over 1 inch in diameter shall be removed from the loam which shall also be free of smaller stones in excessive quantities.

7. The surface for lawn areas shall then be rolled with a hand roller weighing not more than 100 pounds per foot of width.

8. During the rolling, all depressions caused by settlement of rolling shall be filled with additional loam and the surface shall be regraded and rolled until presenting a smooth and even finish to the required grade.

9. Subsequent to or during raking of the loam and at least 4 days prior to seeding, lime shall be applied and raked into the soil over all loam areas.

10. After the lime has been applied and worked into the loam, the entire area shall receive an application of commercial fertilizer. Fertilizer shall be spread in advance of seeding by approved mechanical spreading devices and lightly taken into the top of the soil.

C. Placement of Seed

1. Seed shall be spread at least 4 days after fertilization of the soil by an approved mechanical method and at the rate of 5 pounds per thousand square feet or as noted with seed mix. Seed shall be lightly raked into the soil to a depth of approximately 1/8 inch and no greater than 1/4 inch and the entire seeded area shall be rolled with a lightweight roller.

2. Seeding shall not be done during windy weather.

3. For lawn areas, seeding shall be done in 3 directions, 2 at right angles to each other, and one diagonally.

4. Culti-packer or approved similar equipment may be used to cover the seed and to form the seed bed in one operation. Due to the small size of the seed in the cross-country mix, the Contractor shall increase the bulk prior to seeding by the addition and thorough mixing of sand, Milorganite or other approved materials.

5. Immediately after seeding, all seeded areas shall be watered to a depth of approximately 4 inches and shall be covered with a loose, uniform layer of straw or hay.

3.02 INSTALLATION OF EROSION CONTROL BLANKET

A. Erosion control blanket shall be installed in accordance with the accepted practices and the manufacturer's instructions and recommendations by personnel experienced with similar installations. All products and/or fastenings shall be as supplied by or recommended by the manufacturer, subject to approval by the Engineer.

B. Erosion control blanket shall lay loose on the grade and shall not be stretched or tightened in any direction. The blanket shall conform naturally to the contour and grade of the proposed topography.

C. Anchor slots, butts with structures, walls, curbs, etc., side and junction overlaps and terminal folds shall be made and fastened in accordance with the manufacturer's recommendations or as directed by the Engineer.

3.03 INSTALLATION OF MESH NETTING

A. Mesh netting shall be installed in accordance with accepted practices and the manufacturer's instructions and recommendations by personnel experienced with similar installations. All products and/or fastenings shall be as supplied by or recommended by the manufacturer, subject to approval by the Engineer.

B. Netting shall lay loose on the grade and shall not be stretched or tightened in any direction. The netting shall conform naturally to the contour and grade of the proposed topography.

C. Anchor slots, butts with structures, walls, curbs, etc., side and junction overlaps and terminal folds shall be made and fastened in accordance with the manufacturer's recommendations or as directed by the Engineer.

3.04 MAINTENANCE AND PROTECTION

A. Maintenance shall begin immediately after each portion of the lawn is installed.

B. Lawns shall be maintained for at least 60 days or as much longer as necessary to establish a uniform stand of the specified grasses.

C. Maintenance and protection of seeded areas shall consist of temporary protective fences, barriers, signs, watering, weeding, cutting, and reseeding as necessary, as well as maintaining the straw or mesh cover in a uniform layer.

D. The surface layer of soil shall be kept damp at all times during the germination period. In the absence of adequate rainfall, watering shall be performed two or three times daily or as often as necessary during the germination period and in sufficient quantities to maintain moist soil to a depth of at least 4 inches. Watering shall be done during the heat of the day to prevent the soil from drying out.

E. After first cutting, watering shall be once per week as necessary to supplement natural rain, to the equivalent of 1 inch per week, or to 4 inches in depth. Weekly inspection shall be made to determine the moisture content of the soil and the approved schedule shall be adjusted to fit conditions.

F. At the time of the first cutting, when grass is 4 inches high, mower blades shall be set at 2-l/2 inches high. In subsequent mowings, lawn areas shall be cut to a 2-l/2 inches height with not more than 40 percent of the grass leaf being removed. Naturalized seed mixture shall be cut only once per year during dormant periods as recommended by the manufacturer.

G. All clippings shall be removed after each mowing. Mowing shall be done only in dry weather.

H. The Contractor shall be responsible for providing a second application of commercial fertilizer should lawn work not be accepted within a 90-day period following the first application of fertilizer.

I. Excessive weeds shall be removed by methods approved by the Engineer.

J. The Contractor shall, at his own expense, repair bare spots and/or damage resulting from erosion, gulleys, washouts, or other causes by filling with topsoil and reseeding.

K. In the event that lawn operations are completed too late in the fall for adequate germination and/or growth of grass, maintenance shall continue into the following spring.

3.07 INSPECTION AND ACCEPTANCE

A. The Engineer will inspect the seeded areas upon written request by the Contractor. The request shall be received at least 10 days before the anticipated date of inspection.

B. Inspection and acceptance of seeded areas may be requested and granted in part, provided the area for which acceptance is requested is relatively substantial in size and reasonably regular in shape with clearly definable boundaries.

C. An acceptable seeded area shall be one that has a dense, uniform stand of the specified species. It shall be free of ruts, gullies, bare spots, and the grass areas shall be healthy and free of weeds.

D. Upon acceptance of the work, the Contractor shall be relieved of further responsibility for care or maintenance of accepted lawns.

3.08 DAMAGE AFTER ACCEPTANCE

A. Any lawns damaged after final acceptance of seeded areas and before project acceptance shall be repaired, reseeded, and maintained as specified above with an inspection and formal acceptance required.

3.09 CLEANING UP

A. When any of this work is done while buildings are occupied, pavements shall be kept clear at all times, and broomed clean to prevent tracking dirt into buildings.

B. After completion of all landscaping work, all debris and excess material shall be disposed of to the satisfaction of the Engineer. All pavements shall be broomed and hosed clean.

END OF SECTION

SECTION 02503

PAVING, CURBING, SIDEWALKS, AND ROADWAYS

PART 1 GENERAL

1.01 SCOPE

A. The work covered by this section of the specifications includes furnishing all labor, equipment, tools, and materials, and in performing all operations in connection with roadway pavement overlay, and the replacement of existing paved surfaces, tack coat, installation of bituminous concrete curb, cement concrete sidewalks, bituminous concrete sidewalks, pavement markings, and all incidental work pertaining thereto as indicated on the drawings and as specified herein.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. Prior to the start of construction the Contractor shall prepare, submit and obtain written approval from the Owner for the various proposed methods of site restoration work. As part of this approval process and prior to the start of grading and paving operations, the Contractor and the Contractor's paving subcontractor shall meet with the Owner and Engineer to review the requirements for Project Site restoration. No payment shall be made for any work on this project unless these requirements have been met.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. "Work" shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals shall include shop drawings showing complete fabrication and construction details, materials, weights, dimensions, clearances, anchorage details, piping and utility requirements. Submittals shall include at least the following:

1. Material reports for bituminous concrete pavement job mix formula and tack coat.

2. Material report (job mix formula) for cement concrete.

3. Survey of establishment of roadway grades along the entire length of each roadway.

1.05 PRODUCT HANDLING – Not Used

1.06 DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. Environmental Conditions

1. Permanent paving shall be placed only when the underlying surface is dry, when the atmospheric temperature in the shade is above 40 degrees F, and when the weather is not foggy or rainy, provided, however, that the Engineer may permit, in case of sudden rain, the placing of mixture then in transit from the plant, if laid at proper temperature and if the roadbed is free from pools of water. Such permission shall in no way relax the requirements for quality of the pavement and smoothness of surface.

2. No material shall be laid upon a frozen base course or when wind conditions are such that rapid cooling will prevent satisfactory compaction. No load shall be sent out so late in the day that spreading and compaction cannot be completed during daylight.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials shall conform to the requirements of "The Commonwealth of Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges", latest edition (hereinafter referred to as the "State Specifications") and as specified herein.

2.02 BASE COURSE

A. Gravel base course shall conform to the requirements for gravel fill in SECTION 02220, EARTHWORK, except that the maximum size of stone in the gravel shall be 3 inches.

B. Dense graded crushed stone base course shall conform to the requirements of Section M2.01.7 of the State Specifications.

2.03 BITUMINOUS CONCRETE PAVEMENT

A. The binder and top courses for Class I, Type I-1, bituminous concrete pavement shall conform to the requirements of Section M3.11.00 of the State Specifications.

B. The general composition limits of materials, which make up the Job Mix Formula, shall conform to columns entitled “Binder Course” and “Top Course” as listed in Section M3.11.03 of the State Specifications. No bituminous concrete pavement shall be placed until the Engineer approves the job mix formula.

2.04 BITUMINOUS CONCRETE FOR TEMPORARY SURFACING

A. Hot mixed bituminous concrete shall be as specified hereinbefore for binder course or top course unless otherwise authorized by the Engineer.

B. Cold mixed bituminous concrete shall be a suitable type as approved by the Engineer. Cold mix may only be used when hot mixed bituminous concrete is not available and when authorized by the Engineer.

2.05 TACK COAT

A. Tack Coat shall conform to the requirements of Section M3.03.0 of the State Specifications.

2.06 CONCRETE SIDEWALKS

A. Cement concrete for walks shall be of 4,000 psi compressive strength at 28 days, and shall conform to Section M4.02.00 (air entrained) of the State Specifications.

B. Welded steel wire fabric shall conform to the requirements of Section M8.01.2 of the State Specifications and shall meet AASHTO-M55 and shall have a minimum end-lap of six inches except where expansion joints occur. Mesh shall be 6 inches by 6 inches, W2.9 by W2.9 welded wire fabric.

C. Pre-molded expansion joint filler shall conform to Section M9.14.0 of the State Specifications, and shall meet AASHTO-M153 thickness and widths required for the expansion joint widths.

2.07 PARKING AND ROADWAY MARKINGS

A. Paint for parking and roadway markings shall be a white and/or yellow reflectorized, fast drying paint, conforming to Section M.07.01.0 of the State Specification with glass beads conforming to Section M7.01.07.

B. Markings for parking and roadway shall conform to Section M7.01.03 and M7.01.04 for white and/or yellow.

C. Temporary markings for parking and/or roadways shall conform to Section M7.01.16 for reflective lane tape.

PART 3 EXECUTION

3.01 DUST CONTROL

A. Water shall be applied to control dust. The use of calcium chloride is not allowed.

B. Water shall be uniformly applied at least once a week or as directed by the Owner and/or Engineer.

C. Water for dust control shall be metered and paid for by the Contractor.

3.02 PREPARATIONS FOR BITUMINOUS CONCRETE PAVING

A. Subgrade Preparation

1. All trenches shall be backfilled and compacted as required under the SECTION 02220, EARTHWORK. The edges of all pavements along the line of the trench shall be cut back from exposed edges thereof, a sufficient distance to form a clean, sharp straight edge essentially parallel to the centerline of the trench. The minimum lateral cut back to be allowed will be 12 inches. Cut back pavement shall be carefully removed to minimize any disturbance to foundation materials. The exposed surface of the foundation material shall then be rolled, wetting the surface as necessary to obtain a firm, even surface. Any depressions or uneven areas shall be regraded and re-rolled until the surface is smooth and satisfactorily compacted.

2. The edges of all other pavements (driveways and intersecting roadways) along shall be cut back from exposed edges thereof, a sufficient distance (as determined in the field by the Engineer) to form a clean, sharp straight edge essentially parallel to the centerline of the trench.

3. The Contractor shall rough grade and fine grade all roadways. In order to facilitate grading of the roadways, the Contractor shall establish grades along the entire length of each roadway. Grades shall be established along the centerline of each roadway as well as each side of the roadways. Grading shall be adjusted for driveways aprons and sidewalks. The Contractor shall engage an independent Registered Land Surveyor (in the state where the project is located) with experience with establishing roadways grades. The survey shall be submitted as a shop drawing for review and approval. The Owner has the right to adjust existing roadways grades as part of the final rough grading and fine grading at no cost to the Owner.

4. All surfaces to receive pavements shall be examined by the paving subcontractor to see that they are in proper condition to receive paving. Starting work in any area shall constitute acceptance of that surface. Sub-grade shall be maintained in satisfactory condition and properly drained until surface improvement is placed. All defects resulting from use of unaccepted surfaces shall be corrected by the Contractor at no cost to the Owner.

B. The Contractor shall raise all Owner drain and sewer manhole frames and covers, catch basin frames and grates and gate boxes to the established grades as shown on the Contract Drawings before paving is applied.

C. Prior to submitting its bid, the Contractor shall contact the other utilities so as to gain their requirements concerning any possible adjustment of gate boxes and other such structures. If the utility wishes the Contractor to raise these boxes it shall be in accordance with the utilities requirements. If the utility wishes to adjust their own gate boxes the Contractor shall give the utility adequate notice of his paving schedule.

D. If the gravel base course is disturbed by the adjustment of utilities, the disturbed base material shall be carefully removed and replaced with Portland cement concrete. For additional requirements see DIVISION 3 - CONCRETE.

3.03 DRIVEWAYS

A. All driveways shall be adjusted as required to meet the final grades of the roadway.

B. Bituminous Driveways - Where trenches are excavated through existing bituminous concrete paved driveways, the trench shall be resurfaced to match the existing depth or 2 inch binder course of bituminous concrete (whichever is greater) followed by a 1-1/2 inch top course over the full width of the existing paved driveway. The limits of the overlay course shall be as defined by the Engineer.

C. Brick and Cobblestone Driveways - Where trenches are excavated through existing brick and/or cobblestone driveways, the trench shall be restored with similar materials utilizing existing materials and/or new materials meeting the requirements specified herein. The limits of the restoration shall be as defined by the Engineer

D. Other Types of Driveways - Where trenches are excavated through existing driveway materials not included above, the trench shall be restored with similar materials, including but not limited to color, type, and size, utilizing existing materials and/or new materials. The limits of the restoration shall be as defined by the Engineer.

3.04 LEVELING COURSE

A. Where specified or directed by the Engineer, the Contractor shall install a leveling course of bituminous concrete to the depths as required and as approved by the Engineer. The leveling course shall be installed utilizing bituminous material as specified above for a top course.

3.05 TEMPORARY SURFACING

A. Contractor shall place temporary surfacing as directed by the Engineer. Temporary surfacing shall be placed over trenches in hard surfaced streets and roads, and other areas where directed. Temporary surfacing shall be of bituminous concrete base course as specified herein before, laid in one course, 2 inches thick. Backfill at top of trench shall be removed to allow for placing temporary surfacing.

B. Permanent trench restoration shall be placed the following construction season, allowing the trench to settle over a winter freeze thaw cycle.

C. Contractor shall maintain temporary surfacing in good condition. Trenches shall be inspected at least once a week and also immediately after each storm. Holes and settlements shall be promptly refilled with bituminous mixture.

3.06 PERMANENT SURFACING OF MUNICIPAL STREETS

A. Permanent resurfacing shall occur as specified in SECTION 01030, SPECIAL REQUIREMENTS.

B. Construction requirements for bituminous concrete pavement shall conform to Section 460.60 of the State Specifications.

C. Construction requirements for hot mix asphalt pavement milling shall conform to Section 120.66 of the State Specifications.

D. After the trenches have been completely consolidated and when directed by the Engineer the Contractor shall place full width bituminous concrete pavement. If there has been an appreciable lag in time between installing bituminous concrete courses, or if the binder course has been used extensively during construction, the Engineer shall determine whether tack coat and/or cleaning will be required at no cost to the Owner.

E. Prior to placing bituminous concrete resurfacing over existing pavement, the Contractor shall thoroughly clean and repair the existing pavement to the satisfaction of the Engineer. Upon securing approval, the Contractor shall apply a tack coat as specified and shall place a bituminous concrete mix in an approved manner.

F. Prior to placing bituminous concrete resurfacing, the Contractor shall remove and replace existing curbing in the locations as determined by the Engineer.

3.07 BASE COURSE

A. Construction requirements for gravel base course shall conform to the requirements for gravel fill in SECTION 02220, EARTHWORK.

B. Material as previously specified shall be placed and compacted to the required thickness for the particular application. The moisture content of material may have to be adjusted to obtain the specified compaction. Refer to the SECTION 02220, EARTHWORK for specific compaction requirements. After compaction, all base course for pavements shall be as indicated on the drawings.

3.08 CEMENT CONCRETE SIDEWALKS

A. Construction requirements for cement concrete walks shall conform to the requirement of Section 476 of the State Specifications.

B. Walks shall be sloped as indicated on drawings and slightly adjust grades at intersections as required.

C. Concrete walk sections shall be one-course construction and of thickness, widths, and lengths shown on drawings.

D. The concrete shall be tamped and screened true to grade and section.

E. Expansion joints shall be 1/2 inch expansion joints, with pre-molded fillers here shown on the drawings and at walk junctions and intersections, at top and bottom of steps, and where walks abut building, platforms, or other fixed structures. Expansion joints shall extend full depth of concrete. Pre-molded filler shall extend to within 3/8 inch of the walk surfaces.

F. Control joints shall be located as shown on the drawings, depth and width as required.

G. Finish cement concrete walks shall be finished according to Section 476.67 of the State Specifications. A final medium broom finish shall be applied as indicated on the drawings.

3.09 PARKING STALL LINES AND ROADWAY MARKINGS

A. Parking stall lines and roadway markings shall be painted on non-windy days using whatever methods are necessary to prevent overspray from discoloring pavement. Lines shall be white, 4 inches in width. Six pounds of glass beads shall be added to each gallon paint. Painting, in general, shall conform to Section 860 of the State Specifications.

3.10 REPLACEMENT OF REMOVED CURBS, WALKS, FENCES, STONE WALLS AND OTHER SIMILAR ITEMS

A. All existing curbs, walks, fences, stone walls and other similar items removed for the construction of the sanitary sewer, services, connections, water and/or storm drain lines shall be replaced in a manner equal or better than their original condition.

3.11 REMOVAL AND REPLACEMENT OF BRICK AND COBBLESTONE ROADWAYS, SIDEWALKS, AND DRIVEWAYS

A. Existing brick and cobblestones used for roadways, sidewalks, driveways and/or cross walks shall be removed and place in a protected area.

B. Remove and place in a protected area all edging used for existing roadways, sidewalks, driveways and/or cross walks. It should be noted that existing edging consists of but not limited to steel, aluminum, granite and brick. Reset edging and/or replace any edging broken during removal at no additional cost to the Owner.

C. Remove sufficient depth of existing base materials replace with 6-inches of compacted stone dust for bricks and 6-inches of compacted stone dust and sand mixture at a 50/50 ratio for cobblestone. Rough and fine grade stone dust and compact to the required thickness for the particular application. Reset bricks and/or cobblestones with the smooth (worn and "weathered") side up. Replace any bricks and/or cobblestones broken during removal at no additional cost to the Owner. Spread stone dust between the bricks and/or cobblestones to lock bricks and/or cobblestones in place.

D. Adjust all existing and newly installed utility boxes, frames and covers.

E. Sidewalks shall be sloped away from buildings to no more the ¼-inch per foot maximum toward the roadway. All existing structures including but not limited to tree grades, window wells, curbing, benches, utility boxes, and manholes shall match the elevation of the reset sidewalk.

END OF SECTION

SECTION 02620

INSULATION AND JACKETING

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, equipment, materials, and accessories required to install pipe insulation and jacketing were indicated on the drawings and as specified herein.

B. Insulation and jacketing shall be applied to all pipe and fittings at the following locations:

1. Automatic Air Release/Vacuum Value and Manholes.

2. Drain Manholes.

3. Gravity sewers, force mains, and other wastewater infrastructure components with less than five feet of cover over top of pipe.

4. Other locations as shown on the drawings.

C. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings, brochures and samples shall be submitted for all items to be furnished in accordance with the provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals shall include at least the following:

1. Shop Drawings, including all equipment and components

2. Brochures and/or Catalogue Cuts

3. Installation instructions

4. Certificate of Compliance

5. Manufacturer's Data

1.05 PRODUCT HANDLING

A. All materials shall be shipped, stored, and handled and installed in such a manner as not to degrade quality, serviceability or appearance. The materials shall be stored in a clean, dry location free from construction dust, precipitation and excess moisture. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 DESIGN CRITERIA

A. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

B. Insulation and jacketing system shall be as manufactured by Urecon, LTD, or equal.

PART 2 PRODUCTS

2.01 MATERIALS

A. Insulation

1. General. The pipes and fittings shall be insulated by the Urecon “U.I.P”® void free insulation process, with an outer jacket as specified. Polymer coated, form fitting insulation kits shall be used to insulate elbows, tees and other fittings, according to the manufacturer’s recommendations.

2. Pipe and Fitting Preparation. Pipes and fittings are to be cleaned of surface dust or dirt and treated, if necessary, to assure a positive bond of the foam to the entire pipe surface.

3. Insulation.

a. Material: 141B HCFC Rigid polyurethane foam, factory applied.

b. Insulation thickness: 50 mm (2 in.) for freeze protection.

c. Density: (ASTM D1622) 35 to 46 kg/m3 (3 lbs/ft3).

d. Water absorption: (ASTM D2842) 4% by volume.

e. Closed cell content: (ASTM D2856) 90% minimum.

f. Compressive strength: (ASTM D1621) up to 206 kPa (up to 30 lbs/in.2).

g. Thermal conductivity: (ASTM C-518) 0.020 to 0.026 W/m°C. (0.14 to 0.17 Btu –in./ft2 – hr °F).

h. Service temperature range: -45°C to 120°C (-49°F to + 250°F).

i. Centering: +6.35 mm/ -0 mm (+250 / -0.0 mils).

C. Jacketing

1. Buried Applications

a. The pipe and fittings shall be factory jacketed with a polyethylene jacket, UV inhibited.

b. Minimum density of polyethylene jacket: 940 kg/m3 (58 lbs/ft3).

c. Sealant: Butyl rubber.

d. Jacket thickness: 1.27 mm (50 mils).

e. Maximum elongation: (ASTM D638) 400% 6 month test.

f. Service temperature range: -34°C to 82°C (-30°F to +180F).

g. Water vapor transmission rate: (ASTM 0570-63) 3gm/m2 /24 hrs (0.02 g / 100 in2/24 hrs).

h. Tensile strength: (ASTM G-14-17) 9.8 kg/cm (55 lbs/in.).

2. Exposed Exterior Applications

a. The pipes and fittings shall be factory jacketed with a Spiwrap® 20 gauge, galvanized steel, 4 ply spiral lock seam jacket.

b. Insulation joint detail for pre-insulated pipes with Spiwrap® galvanized steel outer jacket for bridge crossing applications.

D. Insulated pipe joints shall be completed with the use of pre-fabricated urethane half shells and a pre-rolled metal sheet of the same material and gauge as the Spiwrap® outer jacket. The metal sheet shall overlap the insulation jacket by a minimum of 75 mm (3 inches). A circumferential bead of silicone caulking shall be applied to the overlap area of the Spiwrap® jacket prior to the installation of the metal sheet. The metal sheet shall be installed with the longitudinal seam in the 3 o'clock position to act as a drip edge and shall be secured with three stainless steel band assemblies.

E. Field installed insulation kits for pipe joints, valves, couplings, expansion joints and fittings shall consist of rigid polyurethane foam with a fully bonded polymer protective coating on all exterior surfaces, including ends. Kits to be supplied complete with silicone caulking for seams, stainless steel attachment straps, clips and heat shrink sleeves to seal between pipe and kits. In the case of metal jacketed pipe, insulation kits shall have outer form fitting covers of the same material as the pipe jacket.

PART 3 EXECUTION

3.01 INSTALLATION

A. The insulation and jacketing shall be applied to the pipe and fittings at the factory of the insulation company. The Contractor shall coordinate this work with pipe and insulation supplier. Contractor shall provide the piping (specified in other sections) to the insulation/jacketing company for application. Under no circumstances will the Contractor be allowed to field apply the insulation and jacketing, exclusive of pipe joints, valves and fittings. The Contractor shall install the preinsulated and prejacketed pipe and fittings in strict conformance with the insulator's recommendations.

3.02 ACCEPTANCE

A. Upon completion all debris shall be removed from any areas involved with work under this section. Any unsealed seam or unsecured jacketing shall be completely repaired to the satisfaction of the Engineer or the entire section of insulation and jacketing shall be removed and replaced.

END OF SECTION

SECTION 02625

POLYVINYL CHLORIDE SEWER PIPE

PART 1 GENERAL

1.01 SCOPE

A. The Work of this section includes furnishing all labor, materials, tools and equipment and performing all operations in connection with the construction of new polyvinyl chloride (PVC) sewer lines, complete with chimneys, wyes, fittings, service connections, service connection cleanout/TV inspection port, and other related items, as specified herein and as shown on the drawings.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals shall include shop drawings showing complete fabrication and construction details, materials, weights, dimensions, clearances, anchorage details, piping and utility requirements. Submittals shall include at least the following:

1. Pipe and fittings.

2. Gaskets.

1.05 PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer’s written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

1.06 DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Polyvinyl Chloride Pipe, couplings and fittings shall conform to the ASTM D3034, with an SDR of 35 unless otherwise shown on the Contract Drawings or ASTM F789. Joints for PVC pipe shall be push-on joints using permanently bonded elastomeric ring joints. Such joints shall be installed in accordance with the pipe manufacturer's written instructions. Any joint which is not properly made, shows signs of leakage or is in the opinion of the Engineer, defective in any way shall be redone to the satisfaction of the Engineer.

B. Wye Branches or Tees shall be of the same material and of the same class and type so as to be compatible to the pipe they are used with.

C. Pipe utilized for service connections and chimneys shall be 6 inches in diameter and be manufactured of PVC. PVC pipe shall conform to ASTM D3034, with an SDR of 35 or ASTM F789. Joints for PVC pipe shall be push-on using elastomeric ring gaskets.

D. Pipe and fittings for service connection cleanout/TV inspection ports shall be of the same material and of the same class and type so as to be compatible with the pipe they are used.

E. Caps for service connection cleanout/TV inspection ports shall be Model SMARTPlug equipped with a 3M electronic disc marker system as manufactured by GPK Products, Inc. or equal.

F. Concrete utilized for the encasement of chimneys or sewer pipes shall have a minimum compressive strength of 3,000 psi and conform to the specifications in SECTION 03301, MISCELLANEOUS CAST-IN-PLACE CONCRETE.

PART 3 EXECUTION

3.01 PIPE LAYING

A. General

1. All pipe shall be laid with extreme care as to grade and alignment. Each pipe shall be laid so as to form a close joint with the next adjoining pipe and to bring the inverts continuously to the required grade. In order to insure a minimum amount of movement or disturbance, no more than two lengths of pipe may be laid before backfilling to a minimum of 12 inches over the pipe.

2. Suitable coupling holes shall be excavated to provide ample space for making joints and to allow the pipe to have bedding along its entire length. After laying each length to the line and grade shown, the trench shall be backfilled to the midpoint of the pipe and the trench compacted with special care taken to ensure that compacted material is placed under the bell of the pipe. No walking upon or working over the pipe after it is laid will be permitted until it is covered with earth to a depth of at least 12 inches, except as may be necessary for proper compaction. All openings to the pipelines shall be satisfactorily protected to prevent the entrance of earth or water.

B. Laying Pipe

1. Excavations shall be made to accommodate the specified bedding material. All excavations shall be kept dry while pipe is being laid and until each joint and pipe has been viewed by the Engineer and approval given to commence backfilling operations. Any pipe, which is not laid to grade and alignment, shall be relaid to the satisfaction of the Engineer. No blocking shall be used. Pipe shall be installed in accordance with published recommendations of the pipe manufacturer.

2. The pipe shall be set with a laser beam. The laser beam projector shall be rigidly mounted with two-point suspension to its support platforms. This will assure that all ground equipment vibrations will be kept to a minimum and permit the laser beam to project itself coaxially through the center of the pipe. All units shall have equipment to control atmospheric conditions in the pipe that could affect the acceptable standard of construction. The alignment method selected must be shown to have worked satisfactorily on at lease three prior projects and competent, trained personnel shall operate laser. Establish centerline and offset stakes at each manhole, plus one intermediate centerline and offset stakes as a checkpoint between manholes. Laser aligning shall not be used to establish a continuous line in excess of 900 feet.

C. Installation of Wyes and Tees

1. At locations in the field as determined by the Engineer, provide 6-inch wye branches and/or tees. Watertight end caps shall be provided on all wyes and branches until the service is installed.

2. The depth of cover from the road surface to the top of the branch and the distance from the downstream manhole shall also be recorded. No wyes and tees shall be backfilled before the location measurements are taken.

D. Installation of Chimneys

1. Chimneys shall be located as directed by the Engineer, and constructed in accordance with the details shown on the Contract Drawings.

2. Ends of the wye branch shall be capped with standard caps.

E. Service Connections

1. Service connections shall be provided in accordance with the applicable paragraphs of this section of these specifications at a slope of 1/4 inch per foot unless otherwise directed by the Engineer. The extreme end of the service connection shall be capped unless it is to be connected to an existing service.

2. Service connection cleanout/TV inspection ports shall be shall be provided on each service connection at the property line. The service connection/TV inspection ports shall consist of all fittings required including but not limited to pipe, wyes, bends and caps. Service connection cleanout/TV inspection ports are not required for service connections which are less than 10 linear feet in length measured from the property line to the face of the building.

3. No service line shall be connected directly into a manhole unless otherwise directed by the Engineer.

4. All necessary adapters, reduces and the like shall be provided to connect to existing services.

5. A steel marker (1/2-inch in diameter by 2 foot long) shall be installed at the end of capped lines unless it is to be connected to an existing service.

6. All services lines shall be tied into a minimum of three points including, if possible, the permanent corners of the building which is to be served. The depth of cover from the ground surface to the top of the pipe at the cap shall be recorded. The depth and tie information shall be made part of the Project Record Documents.

3.02 LEAKAGE AND TESTING

A. After the completed sewer line, including service connections has been provided, the trench has been compacted to specification requirements, and manhole or joints showing noticeable streams or jets have been repaired and/or replaced perform all tests.

B. Furnish all labor, materials and equipment necessary so that testing can be accomplished at the times and locations the Engineer deems necessary.

C. Test Procedure

1. Sewers not meeting the requirements stated herein shall be repaired as necessary at no cost to the Owner.

2. Low-Pressure Air Test. Utilize equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. The equipment shall be provided with an air regulator valve or air safety valve so set that the internal air pressure in the pipeline cannot exceed 8 psig.

3. The leakage test using low-pressure air shall be made on each manhole-to-manhole section of pipeline.

4. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressure without requiring external bracing or blocking.

5. All air used shall pass through a single control panel.

6. Low-pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe at the time of the test. However, the internal air pressure in the sealed line shall not be allowed to exceed 8 psig.

7. At least 2 minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig (greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe) shall not be less than that shown in the following table:

Pipe diameter (inches)	Time (minutes)
6	4.0
8	5.0
10	6.5
12	7.5
14	9.0
15	9.5
18	11.5
Greater then 18	7.7 X Pipe Diameter (feet)

8. When the sewer section to be tested contains more than one size of pipe, the minimum allowable time shall be based on the largest diameter pipe in the section.

3.03 ALLOWABLE PIPE DEFLECTION FOR PVC PIPE

A. Pipe installed under this specification shall have a maximum deflection of 5 percent at the time of testing. Such deflection is defined as the amount of vertical deformation (nominal inside diameter less the minimum vertical diameter when measured) multiplied by 100 and divided by the nominal diameter of the pipe.

B. Upon completion of a sewer section, including the placement and compaction of backfill, and the cleaning of the sewer, measure the amount of deflection in all of the sewer lines. This testing shall be done by the use of a deflectometer, calibrated television or photography, or a properly sized "go, no go" mandrel or sewer ball. The method of deflection testing shall have the written approval of the Engineer.

C. All sewer lines with a deflection angle of greater than 5 percent shall be repaired by re-bedding or replacement of the pipe.

3.04 VISUAL INSPECTION

A. At the conclusion of the work, all pipelines shall be visually inspected by the Engineer to insure a straight and plumb alignment.

B. All pipelines which are not straight and plumb shall be removed and replaced at no cost to the Owner.

3.05 CLEANING

A. At the conclusion of the work, thoroughly clean the sewers by flushing with water or other means to remove dirt, stones, and other material. Prior to acceptance, all pipelines shall be inspected for cleanliness and to be sure no sandbags, broken pipe or other obstructions exist.

END OF SECTION

SECTION 02630

DUCTILE IRON FORCE MAIN

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with the construction of ductile iron (DI) force main, complete with fittings, and other related items, as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Pipe and fittings.

2. Gaskets.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ductile iron pipe shall be of the size as shown on the drawings with a thickness class of 52 unless otherwise shown on the drawings. All ductile iron pipe shall be centrifugally cast and conform to ANSI A21.51 and ANSI A21.50. All pipe shall be made of ductile iron equal to grade 60-42-10. The pipe shall be in nominal laying lengths of 18 to 20 feet. Joints shall be mechanical type with rubber gaskets and shall conform to ANSI A21.11. Fittings shall be cast-iron with mechanical joints conforming to all requirements of ANSI A21.10. The pipe shall be coated on the outside and inside in accordance with the requirements of ANSI A21.51. As an alternative, with no additional cost to the Owner, the pipe may be cement lined to twice the thickness specified in ANSI A26.51 and ANSI 21.4 and shall be asphalt seal coated twice.

B. Concrete utilized for thrust blocks shall have a minimum compressive strength of 3,000 psi and conform to the specifications in SECTION 03310, CAST-IN-PLACE CONCRETE.

PART 3 EXECUTION

3.01 GENERAL

A. Force main shall be laid as shown on the drawings with a continuous slope between the high and low points defined on the drawings.

3.02 LAYING PIPE

A. Excavations shall be made to accommodate the bedding material as specified in SECTION 02220, EARTHWORK. All excavations shall be kept dry while pipe is being laid and until each joint and pipe has been viewed by the Engineer and approval given to commence backfilling operations. Any pipe, which is not laid to grade and alignment, shall be relaid to the satisfaction of the Engineer. No blocking shall be used. Pipe shall be installed in accordance with published recommendations of the pipe manufacturer.

3.03 THRUST BLOCKS

A. Concrete thrust blocks shall be placed at all force main bends 11-1/4 degrees and greater, at fittings and as designated by the Engineer, and shall conform to the drawings.

3.04 TESTING

A. The force main shall be tested in the presence of the Engineer, by water to a pressure equal to 2 times the total dynamic head of the pump to which the force main is attached, unless the test pressure is greater than the working pressure of the pipe. In that case the pipe shall be tested to the working pressure of the pipe. The Engineer shall provide the test pressure. This pressure shall be held for a period of at least 15 minutes, with no pressure drop. Any defective work shown by this test shall be replaced at no additional cost to the Owner.

B. All equipment, labor, water, gauges, and the like for the testing of the force main shall be supplied at no additional cost to the Owner.

END OF SECTION

SECTION 02702

CLEANING AND TELEVISION INSPECTION OF SEWER LINES

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes the furnishing of all labor, materials and equipment required to clean, televise, and video tape the existing and/or new sewer lines during high groundwater conditions as determined by the Owner/Engineer, unless specified otherwise/directed by the Owner/Engineer.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and Payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and brochures shall be submitted for all items to be furnished in accordance with the provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Contractor's description of all equipment to be used.

2. Contractor's description of its proposed methodology.

3. The Contractor shall submit a typed written report including television inspection logs for all work performed. These logs at a minimum should include: stationing, location of reference points, point of entry of service connections via a clock system, observed running leaks, observed continuously running service connections, bad joints, sags in pipes, and other evidence of potential problems.

4. Color DVDs and Inspection Logs.

1.05 DESIGN CRITERIA

A. The work covered by this specification shall be in accordance with the best practice of the industry. The specifications call attention to certain features but do not purport to cover all details entering into the required work.

PART 2 PRODUCTS - NOT APPLICABLE

PART 3 EXECUTION

3.01 CLEANING

A. Cleaning shall be accomplished with high pressure hydraulic cleaning equipment or mechanical cleaning equipment followed by hydraulic cleaning.

1. "Light Cleaning" as used in these specifications, shall be equivalent to 1 to 2 passes of the hydraulic jet through the sewer lines.

2. “Moderate Cleaning” as used in these specifications shall be equivalent to 3 to 4 passes of the hydraulic jet through sewer lines.

3. “Heaving Cleaning” as used in these specifications shall be equivalent to more than 4 passes of the hydraulic jet through the sewer lines or use of mechanical equipment to remove debris, including substantial root mass, to render the line clean.

B. For existing sewer lines, each method shall be able to remove sufficient material to render the sewer line capable of handling 95 percent of its original design capacity. Each method shall also include root removal using equipment appropriate for the conditions.

C. For new sewer lines, each method shall be able to remove sufficient material to render the sewer line capable of handling 100 percent of its design capacity.

D. Equipment

1. Mechanical equipment shall be equipped with a belt booster clutch or overload clutch so that the pipe will not be damaged. No equipment of a direct drive type shall be permitted.

2. High pressure hydraulic equipment shall not operate under a "head of water" unless written approval is obtained from the Engineer.

3. High pressure hydraulic cleaning equipment shall be capable of producing flows from a fine spray to a solid stream and shall have a selection of two or more high pressure nozzles (approximately 2,000 pounds per square inch).

4. Satisfactory precautions shall be taken to protect the sewer lines at all times. All workmen shall be experienced and skilled in the use of the equipment used.

E. Disposal of Debris

1. All sludge, dirt, sand, gravel, roots, grease and other debris resulting from the cleaning operation shall be placed in a suitable container and legally disposed of by the Contractor.

2. No sewage or materials removed from the sewer shall be dumped or pumped into the streets or into water courses, ditches, catch basins or other drains or sewers.

3. The Contractor shall use suitable equipment to ensure that no solids are permitted to go downstream.

3.02 COLOR TELEVISION INSPECTION

A. General

1. The television camera used for the inspection shall be a 360 degree pan and tilt camera specifically designed and constructed for inspection of sewer lines.

2. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. The camera shall be operative in 100 percent humidity conditions and have a minimum of 600 line-resolutions. Picture quality and definition shall be to the complete satisfaction of the Engineer and if unsatisfactory, the equipment shall be removed and replaced with equipment of satisfactory quality.

B. Sewer Lines

1. The inspection shall be done one section at a time and the section being inspected shall be suitably isolated from the remainder of the sewer system as required.

2. The camera shall be moved through the line in either direction at a uniform slow rate by means of cable winches located at manholes on each side of section being televised.

3. Means of communications shall be set up between the two winches and the monitor control. Photographic pictures shall be taken of the television monitor when directed by the Engineer.

C. Service Connections

1. Existing - The Contractor shall video tape the entire length of each service connection in order to identify defects that may exist in the lines. This inspection shall occur after the connection has been made by adding a cleanout to each service connection located at the property line.

2. New - The Contractor shall video tape the entire length of each service connection from the main line to the cleanout to each service connection located at the property line.

3.03 FLOW CONTROL

A. Existing Sewer Lines

1. Cleaning shall be performed only when the depth of flow in the sewer line is at or below 1/3 of the pipe diameter. When the depth of flow in the sewer line is above 1/3 of the pipe diameter, flow control methods shall be utilized as specified in SECTION 02735, FLOW CONTROL OF SEWER LINES, before cleaning is performed.

2. Television inspection shall be performed only when the depth of flow in the sewer line is at or below 1/4 of the pipe diameter. When the depth of flow in the sewer line is above 1/4 of the pipe diameter, flow control methods shall be utilized as specified in SECTION 02735, FLOW CONTROL OF SEWER LINES, before television inspection is performed.

3. Flow measurement shall be performed only when the sewer line is not surcharged. When the sewer line is surcharged, the base flow is too great, or when directed by the Engineer, flow measurement shall not be performed and flow control methods shall be utilized as specified in SECTION 02735, FLOW CONTROL OF SEWER LINES, to eliminate surcharging and/or reduce the flow.

B. New Sewer Lines

1. Cleaning shall be performed upon completion of the installation of the gravity system.

3.04 REPORTS

A. Television, inspection logs and cleaning logs cleaning logs shall be furnished to the Engineer.

B. Television inspection of the entire line shall be recorded on DVD. Where deficiencies and leaks are noted, the camera shall be stopped to observe the condition, information recorded and photographs taken as directed by the Engineer. Three copies of color video tapes shall be provided.

C. Television inspection logs shall be prepared and shall include identification of the section of pipe and pipe size. Records shall also include location of reference points, point of entry of service connections via a clock system, observed running leaks, observed continuously running service connections, bad joints, sags in pipes, and other evidence of potential problems. Three copies of inspection logs shall be provided.

D. Cleaning logs shall be prepared and shall include identification of the section of pipe and pipe size. Three copies of inspection logs shall be provided.

3.05 CLEAN-UP

A. The Contractor shall be responsible for the legal disposal of removed materials and general clean-up of the work area as approved by the Engineer.

3.06 FINAL ACCEPTANCE

A. Final acceptance of the sewer line cleaning shall be made upon completion of the television inspection as approved by the Engineer.

B. Final acceptance is based on the existing sewer's ability to carry 95 percent of its original design capacity and based on the new sewer's ability to carry 100 percent of its design capacity.

END OF SECTION

SECTION 02722

SPECIAL MANHOLES

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes the furnishing of all labor, materials, tools and equipment necessary to construct precast concrete special manholes including bases complete with steps, frames and covers, fittings, valves and piping as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Precast concrete sewer manholes.

2. Frames and covers.

3. Horizontal joint sealing material.

4. Pipe connections.

5. Manhole steps.

6. Manhole Encapsulation System.

7. Valves, Piping and Fittings.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE FOR SPECIAL MANHOLES

A. Precast reinforced concrete sections shall conform to the applicable requirements of ASTM C478. Sections and bases shall have a minimum wall thickness of the dimensions shown on the attached drawings. Unless otherwise detailed on the drawings all sections shall be of precast concrete. Manholes shall have a minimum inside diameter of five feet and shall have a minimum inside height of seven feet.

B. The exterior of all manholes shall be bituminous coated

C. Air release and vacuum manholes interior walls, floor and ceiling shall be coated from the bottom to the top with a high build epoxy. Refer to SECTION 09900, PAINTING.

2.02 HORIZONTAL JOINTS

A. Horizontal joints between sections of manholes, unless otherwise specified herein, shall be sealed with a self-sealing butyl rubber based flexible joint sealant in rope form.

B. Sealant material shall be Kent-Seal No. 2 as manufactured by Hamilton-Kent Mfg. Co., Kent, Ohio; C-S146 as manufactured by Concrete Products Supply Co. Div., Press Seal Gasket Corp., Fort Wayne, Indiana; Ram-Nek as manufactured by K.T. Snyder Co., Inc., Houston, Texas, or equal. Sealant shall be installed in accordance with the manufacturers written instructions.

2.03 MANHOLE STEPS

A. Manhole steps shall be of steel reinforced copolymer polypropylene conforming to ASTM C478, cast-in-place or installed utilizing inserts approved by the Engineer.

B. All steps shall be 12 inches on center with abrasive step surface and safety edge, drop front design, 1-inch diameter and 16 inches wide. Metal items embedded in concrete shall be painted with a zinc chromate primer.

2.04 PIPE CONNECTIONS

A. Premolded elastomeric sealed joints shall be used at the joints between the pipe and sewer manhole sections. Premolded elastomeric sealed joints shall be A-Lok, Res-Seal, Press-Wedge II, Lock Joints Flexible Manhole Sleeve, Kor-N-Seal Joint Sleeve, or equal.

2.05 MANHOLE COVERS AND FRAMES

A. Manhole frames and covers shall be cast iron with a minimum total weight of 475 pounds with a clear opening of 26 inches, unless otherwise indicated on the Contract Drawings. Manholes frames and covers shall conform to the requirements of ASTM A48, Class 30, and shall be of noiseless, non-rocking design with pick holes. The word "Sewer," "Drain," "Process", "Electrical", "Chemical", "Telephone", or "Valve” shall be cast on each cover in 3-inch high letters as applicable.

B. Watertight manhole frames and covers shall have a minimum total weight of 520 pounds with a clear opening of 26 inches, unless otherwise indicated on the Contract Drawings. Watertight manhole covers shall have a gasketed interior cover of watertight design, and shall also contain a locking bar. The word "Sewer," "Drain," "Process", "Electrical", "Chemical", "Telephone", or "Valve" shall be cast on each cover in 3-inch high letters as applicable. All electrical handhole and chemical or process pullboxes and manholes shall have watertight manhole frames and covers, unless otherwise indicated on the Contract Drawings.

2.06 BRICK

A. Brick shall conform to ASTM C32 and shall be new, first quality, whole, sound brick.

B. For tables and inverts, Type SS bricks shall be used with cement mortar (no lime).

C. For setting frames, Type MS bricks shall be used with mortar as specified.

2.07 MORTAR

A. Mortar shall be composed of one part Portland cement to two parts sand with 20 percent hydrated lime.

B. Portland cement shall conform to the requirements of ASTM C150. Sand shall conform to the requirements of ASTM C144. Hydrated lime shall conform to the requirements of ASTM C207.

2.08 WATER

A. Water shall be clean, fresh and free from organic matter, oil, acid, alkali or deleterious substances.

2.09 BEDDING MATERIAL

A. Bedding material under manholes shall conform to the requirements of pipe bedding material as specified in SECTION 02220, EARTHWORK.

2.10 CONCRETE

A. Concrete for floor fillings, encasements, and similar items shall be as specified in SECTION 03310, CAST-IN-PLACE CONCRETE

2.11 AIR RELEASE VALVE AND AIR AND VACUUM VALVE

A. An air release valve and an air and vacuum valve shall be installed at the last high point and air release valves shall be installed at all the high points in the force main as shown on the drawings and as specified herein. The air release valve shall allow for the release, without large surges, or trapped gases under flow and no flow conditions. The air and vacuum valve shall allow for the admission or release of large quantities of air during force main fill-up or drainage.

B. Piping and valves within the air release and air and vacuum manholes shall be insulated and jacketed as specified in SECTION 02620, INSULATION AND JACKETING. Primer shall be in accordance with paint manufacturer's recommendations. The maximum coverall height of each valve, with accessories, shall not exceed 26 inches.

1. The air release valves shall be specially designed for use with raw sewage leachate. The valve shall be designed such that improper operation of the valves caused by the wastewater constituents is minimized.

    a. The valve shall consist of a cast iron body enclosing a stainless steel float attached with a stainless steel rod to a stainless steel lever mechanism having stainless steel lever pins. The lever mechanism shall have a Buna-N needle which will close an air release orifice with the float rises because of a rise in sewage level in the valve body. As air displaces the sewage in the valve body, the float will drop, thus pulling the needle out of the orifice and allowing the air to escape. The orifice seat shall be made of suitable corrosion resistant synthetic materials.

    b. The valve shall have a 2-inch inlet with a shut-off valve, a blow off valve for removing accumulated sediment, and a shutoff valve with a 1/2-inch quick disconnect coupling for introducing clean water into the valve body for cleaning purposes. A 1/2-inch quick disconnect coupling shall also be provided on the air release orifice for cleaning purposes. A five foot length of rubber hose with 1/2-inch quick disconnect couplings shall be provided.

    c. The air release valve shall be suitable for use at an operating pressure of approximately 7 psig, but shall be constructed to be safe at operating pressure up to 150 psig.

2. The air and vacuum valve shall be specially designed for use with raw sewage. The valve shall be designed such that improper operation of the valve caused by sewage constituents is minimized. The valve shall open when the operating pressure falls below atmospheric pressure, and shall close and remain closed when the operating pressure is above atmospheric pressure.

    a. The valve shall consist of a cast iron body enclosing two stainless steel floats attached with a stainless steel rod. The air release orifice shall be in a cast iron valve body cover and shall have a Buna-N rubber seat. As the sewage level rises in the valve body, the floats will rise so that the upper float seats in the orifice and prevents air from escaping. The floats shall be guided by a stainless steel float guide.

    b. The valve shall have a 2-inch inlet with shutoff valve, a 1-inch orifice, a blow off valve for removing sediment and a shut off valve with a 1/2-inch quick disconnect coupling for admitting clean water for cleaning purposes.

    c. The air and vacuum valve shall be suitable for operation at a pressure of 7 psig, but shall be constructed so as to be safe at operating pressures up to 150 psig.

2.12 FORCE MAIN DRAIN MANHOLES

A. Force main drain manholes shall be located as shown on the drawings and shall be of precast construction to the dimensions detailed. Drain manholes shall include a precast concrete manhole and all pipes, fittings, and valves necessary for draining purposes as shown on the drawings.

2.13 GATE VALVES

A. Gate valves shall be iron body, bronze mounted and have solid wedges. The valves shall be designed for 150 psi working pressure. Interior gate valves shall be flanged O.S. & Y. and have a packing seal and shall be hand-wheel operated with extension stems as required.

2.14 KNIFE VALVES

A. Knife valves shall be of the wafer body design to minimize the flange to flange length. Flanges shall have raised faces and shall be ANSI B16.34, Class 150 standard. Seats shall be of the raises face design to prevent the packing of solids in the seat area. Reinforcing body ribs shall be incorporated on all valves six inches and larger. All wetted parts shall be of T-304 stainless steel, including gate, body lining, chest and packing area, and stem. The outer body shall be semi-steel and the yoke bronze. Packing shall be of flax. Operators shall be of the manual actuator type with handwheels on the gear operators.

2.15 VALVE COATING

A. Exterior surfaces of all valves shall be coated with a minimum of three applications of an approved bituminous solution, on a rust-casting, prior to shipment. Body ring shall be free of any bitumastic solution. Valve interiors shall have a two part thermoset for fusion bonded epoxy protective coating system, and meet all requirements of AWWA C550.

2.16 CARBON ODOR CONTROL UNIT – Not Used

2.17 MANHOLE ENCAPSULATION SYSTEM

A. All manholes shall be installed with an external manhole encapsulation system that seals the interface between the precast concrete manhole and the frame and cover.

B. The manhole encapsulation is a heat shrinkable wraparound sleeve system and shall have an overall thickness of 0.100 inches with a minimum width of 6 inches. The manhole encapsulation shall be “Wrapid Seal Manhole Encapsulation System” as manufactured by Canusa, A Division of Shaw Pipe Resources.

PART 3 EXECUTION

3.01 PRECAST REINFORCED CONCRETE

A. Precast reinforced concrete structures shall be installed as shown on the drawings. Precast sections shall be installed so that entire structure is vertically plumb and the steps are in a true line. All erection holes shall be filled solid with non-shrinking grout. The top uppermost precast section shall be set at a grade that will allow for the installation of a minimum of two courses and a maximum of five courses of brick and mortar prior to setting the cast iron frame and cover. The Contractor shall furnish and use suitable slings, hooks and cables for the proper handling of the sections.

B. Surfaces of sewer pipe to be bonded to cast in place concrete bases shall be cleaned of all dust, dirt, grease, laitance, and loose or spalling concrete and given, where applicable, a coat of bonding compound in conformance with the sealant or gasket manufacturer’s recommendations.

3.02 MANHOLE COVERS AND FRAMES

A. If overlay pavement is required by the Owner, the covers and frames shall be set 1/4 inch below the finish grade of the roadway utilizing cement mortar to hold the frame in place, as detailed.

B. The temporary roadway surface elevation shall be maintained and the frames, and covers shall be set 3/4 inch above the grade of the temporary resurfacing utilizing either cement mortar or bituminous concrete to hold the frame in place. A slope, constructed of bituminous concrete pavement, shall be placed around the entire grate, frame and cover for a distance of 6 inches from the grate, frame and cover.

C. Any voids created in the road gravel or pavement when raising the grate, frame and cover from its temporary elevation to its permanent elevation shall be filled with concrete.

3.03 VACUUM TEST

A. Vacuum tests shall be made and observed by the Engineer on each manhole.

B. Preparation for Testing

1. The test shall be made after the manhole had been assembled in place, all lifting holes and horizontal joints shall be filled and pointed with an approved non-shrinking mortar, but prior to filling and pointing the horizontal joints.

2. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged and plugs braced to prevent blow out.

3. The test may be conducted before backfilling around the manhole.

C. Test Procedures

1. The Contractor shall take any and all steps necessary to assure the Engineer that the water table is below the invert of the manhole throughout the test. Any and all measures necessary by the Contractor to lower the ground water table below the invert of the manhole will be at the Contractor's cost. The vacuum test shall be based on the following criteria:

a. Manhole test pressures and time shall be as follows:

(1) Initial test pressure, 10 inches Hg (i.e., 20 inch absolute).

(2) Test time, 1 inch Hg drop to 9 inch Hg in 2 minutes minimum allowable, for 0 to 10 foot deep manholes; 2-1/2 minutes minimum allowable for 10 foot to 15 foot deep manholes; 3 minutes minimum allowable for manholes greater than 15 foot in depth.

b. If the pressure drop exceeds 1 inch Hg in 2 minutes the manhole shall be repaired and retested.

c. Testing shall be done prior to backfilling to assist in locating leaks. Joint repairs by parging are to be done on both outside and inside of the joint to ensure a permanent seal. Vacuum testing draws together the joint and applies high pressure to the elastomeric joint material. Properly placed and sized elastomeric joint material must be used to avoid leakage or to enable sections to be separated if necessary to effect a repair.

3.04 MANHOLE ENCAPSULATION SYSTEM

A. The external manhole encapsulation system shall be installed in accordance with the manufacturer's instructions. All surfaces shall be free of dirt, sharp points and preheated to remove moisture.

B. The Contractor's personnel shall be trained by the manufacturer in the proper method of application of the external manhole encapsulation system. The Contractor shall have the manufacturer's field service representative present during the application of external manhole encapsulation system on the first two manholes installed.

3.05 VISUAL INSPECTION

A. At the conclusion of the work, all manholes shall be visually inspected by the Engineer to insure a straight and plumb alignment.

B. All manholes that are not straight and plumb shall be removed and replaced.

3.06 CLEANUP

A. Upon completion, of all construction and testing, and prior to final acceptance all debris shall be removed from manholes and the tables cleaned.

END OF SECTION

SECTION 02725

MANHOLES, CATCH BASINS, HANDHOLES, AND PULL BOXES

PART 1 GENERAL

1.01 SCOPE

A. The Work of this section includes furnishing all labor, materials, tools and equipment necessary to construct precast concrete manholes, catch basins, handholes, and pull boxes including bases complete with inverts, tables, steps, frames, grates and covers, mancatchers, fittings, piping and concrete encasements for drop manholes as specified herein and as shown on the Contract Drawings

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals shall include shop drawings showing complete fabrication and construction details, materials, weights, dimensions, clearances, anchorage details, piping and utility requirements. Submittals shall include at least the following:

1. Precast concrete manholes, catch basins, handholes and pull boxes.

2. Frames, covers, and grates.

3. Horizontal joint sealing material.

4. Pipe connections.

5. Manhole steps.

6. Manhole Encapsulation System.

1.05 PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer’s written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

1.06 DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE SECTIONS FOR DRAIN, SEWER AND VALVE MANHOLES, CATCH BASINS, AND CHEMICAL OR PROCESS PULL BOXES

A. Precast reinforced concrete sections for drain manholes, sewer manholes, valve manholes, chemical or process manholes, (hereinafter referred to as "manholes") and catch basins, shall conform to the applicable requirements of ASTM C478. Sections and bases shall have a minimum wall thickness of the dimensions shown on the Contract Drawings. Unless otherwise detailed on the Contract Drawings all sections shall be of precast concrete. Flat top sections to be substituted for conical sections of manholes and catch basins in areas of low cover shall be indicated in submittals, and shall conform to the requirements for precast concrete sections for handholes.

B. Unless otherwise shown on the Contract Drawings manholes shall be 4-foot in diameter for pipe up to 24 inches in diameter unless the angle between two 24-inch pipes is less than 120 degrees. In such cases and when the size of the pipe is less than 36 inches a 5-foot inside diameter manhole shall be used. Where the pipe is 36 inches in diameter or greater, the diameter of the structure shall be as shown on the Contract Drawings.

C. Exterior surfaces of all precast manholes shall be given one shop coat of bituminous waterproofing.

2.02 HORIZONTAL JOINTS

A. Horizontal joints between sections of manholes, unless otherwise specified herein, shall be sealed with a self-sealing butyl rubber based flexible joint sealant in rope form. Sealant material shall be Kent-Seal No. 2 as manufactured by Hamilton-Kent Mfg. Co., Kent, Ohio; C-S146 as manufactured by Concrete Products Supply Co. Div., Press Seal Gasket Corp., Fort Wayne, Indiana; Ram-Nek as manufactured by K.T. Snyder Co., Inc., Houston, Texas, or equal. Sealant shall be installed in accordance with the manufacturers written instructions.

B. Horizontal joints between sections of precast concrete drain manholes and catch basins shall be mortared with mix specified herein.

2.03 MANHOLE STEPS

A. Manhole steps shall be of steel reinforced copolymer polypropylene conforming to ASTM C478, cast-in-place or installed utilizing inserts approved by the Engineer.

B. All steps shall be 12 inches on center with abrasive step surface and safety edge, drop front design, 1-inch diameter and 16 inches wide. Metal items embedded in concrete shall be painted with a zinc chromate primer.

2.04 PRECAST CONCRETE SECTIONS FOR ELECTRICAL MANHOLES, HANDHOLES, AND PULL BOXES

A. Electrical manholes, handholes, and pull boxes shall have a minimum 28 day compressive strength of 5,000 pounds per square inch, reinforced for AASHTO H-20 loading with Grade 40 or Grade 60 steel in conformance with ASTM A615.

2.05 PIPE CONNECTIONS

A. Premolded elastomeric sealed joints shall be used at the joints between the pipe and sewer manhole sections. Premolded elastomeric sealed joints shall be A-Lok, Res-Seal, Press-Wedge II, Lock Joints Flexible Manhole Sleeve, Kor-N-Seal Joint Sleeve, or equal.

B. Mortar shall be used between pipe and structure in the storm drainage systems. Mortar mix shall be as specified herein.

C. Manholes shall be manufactured with knockout panels for future pipe connections/ extensions at the locations shown on the Contract Drawings.

2.06 MANHOLE FRAMES AND COVERS

A. Manhole frames and covers shall be cast iron with a minimum total weight of 475 pounds with a clear opening of 26 inches, unless otherwise indicated on the Contract Drawings. Manholes frames and covers shall conform to the requirements of ASTM A48, Class 30, and shall be of noiseless, non-rocking design with pick holes. The word "Sewer," "Drain," "Process", "Electrical", "Chemical", "Telephone", or "Valve" shall be cast on each cover in 3-inch high letters as applicable.

B. Watertight manhole frames and covers shall have a minimum total weight of 520 pounds with a clear opening of 26 inches, unless otherwise indicated on the Contract Drawings. Watertight manhole covers shall have a gasketed interior cover of watertight design, and shall also contain a locking bar. The word "Sewer," "Drain," "Process", "Electrical", "Chemical", "Telephone", or "Valve" shall be cast on each cover in 3-inch high letters as applicable. All electrical handhole and chemical or process pullboxes and manholes shall have watertight manhole frames and covers, unless otherwise indicated on the Contract Drawings.

2.07 BRICK

A. Brick shall conform to ASTM C32 and shall be new, first quality, whole, sound brick.

B. For tables and inverts, Type SS shall be used with cement mortar (no lime).

2.08 MORTAR

A. Mortar shall be composed of one part Portland cement to two parts sand with 20 percent hydrated lime.

B. Portland cement shall conform to the requirements of ASTM C150. Sand shall conform to the requirements of ASTM C144. Hydrated lime shall conform to the requirements of ASTM C207.

2.09 WATER

A. Water shall be clean, fresh and free from organic matter, oil, acid, alkali, or deleterious substances.

2.10 BEDDING MATERIAL

A. Bedding material under structures herein shall be as detailed and as specified in SECTION 02220, EARTHWORK.

2.11 CONCRETE

A. Concrete for tables, inverts, paved invert fillings, encasements, floor fillings and similar items shall be as specified in SECTION 03301, MISCELLANEOUS CAST-IN-PLACE CONCRETE.

2.12 POLYVINYL CHLORIDE PIPE

A. Polyvinyl Chloride pipe for drop manhole connections shall conform to ASTM D3034 and shall be SDR35.

2.13 MID LEVEL PLATFORM

A. All manholes with a depth of 20 feet or greater from rim to invert shall have installed at the midpoint of the manhole a mid-level platform. The mid-level platform shall be installed in accordance with the details on the Contract Drawings.

2.14 MANHOLE ADJUSTING RINGS

A. All manholes shall be installed with HDPE Manhole Adjusting Rings as manufactured by Ladtech, Inc. or equal. HDPE Manhole Adjusting Rings shall be molded from high-density polyethylene as defined by ASTM D1248. Recycled HDPE material is allowed to be used during the manufacture of the rings.

B. Horizontal joints between sections of the HDPE Manhole Adjusting Rings shall be sealed with a self-sealing butyl rubber based flexible joint sealant in caulk form. Horizontal joints between sections of the HDPE Manhole Adjusting Rings and Manhole Frame or Manhole Cone/Top Slab shall be sealed with a self-sealing butyl rubber based flexible joint sealant in rope form. Sealants shall be installed in accordance with the manufacturer's written instructions.

2.15 MANHOLE ENCAPSULATION SYSTEM

A. All manholes shall be installed with an external manhole encapsulation system that seals: (1) the interface between the precast concrete manhole and the frame and cover and (2) all manhole joints which are located below groundwater.

B. The manhole encapsulation system shall be designed to prevent leakage of water into the manhole and shall be either one of the following:

1. The manhole encapsulation system shall be a heat shrinkable wraparound sleeve system and shall have an overall thickness of 0.100 inches with a minimum width of 12 inches. The manhole encapsulation shall be “Wrapid Seal Manhole Encapsulation System” as manufactured by Canusa, A Division of Shaw Pipe Resources or equal.

2. The manhole encapsulation system shall be a rubber sleeve made of EPDM (Ethylene Propylene Diene Monomer) rubber with a minimum thickness of 65 mils with a minimum width of 12 inches. Each unit shall have a 2-inch wide mastic strip on the top and bottom edge of the rubber wrap. The mastic shall be non-hardening butyl rubber sealant, with a minimum thickness of ¼-inch. The manhole encapsulation shall be “Infi-Shield Seal Wrap” as manufactured by Sealing System, Inc. or equal.

PART 3 EXECUTION

3.01 PRECAST REINFORCED CONCRETE STRUCTURES

A. Precast Reinforced Concrete Structures shall be installed as shown on the Contract Drawings and at a maximum spacing of 300 linear feet. Precast sections shall be installed so that the entire structure is vertically plumb and the steps are in a true line. All erection holes and horizontal joists shall be filled solid with non-shrinking grout. The top uppermost precast section shall be set at a grade that will allow for the installation of a minimum of two courses and a maximum of five courses of manhole adjusting rings prior to setting the cast iron frame and cover. Furnish and use suitable slings, hooks and cables for the proper handling of the sections.

B. Surfaces of sewer pipe to be bonded to cast-in-place concrete bases shall be cleaned of all dust, dirt, grease, laitance, and loose or spalling concrete and given, where applicable, a coat of bonding compound in conformance with the sealant or gasket manufacturers recommendations.

C. Tables and inverts shall be constructed of brick and concrete for sewer manholes, and of concrete for drain manholes as shown on the Contract Drawings. The size and shape of the invert shall accurately conform to the adjoining sewer or drains pipes. Any change in size or direction shall be even and as gradual as possible. Concrete floor filling for chemical or process pullbox sumps shall be as shown on the details.

D. Knockout panels for future sewer extensions shall be manufactured into precast manhole, as specified above, at the locations shown on the Contract Drawings. Stubs shall not be used.

3.02 MANHOLE COVERS AND FRAMES

A. In paved surfaces, grates, covers and frames shall be set 1/4-inch below the finish grade of the roadway utilizing cement mortar to hold the frame in place, as shown of the Contract Drawings.

B. The temporary roadway surface elevation shall be maintained and the grates, frames, and covers shall be set 3/4 inch above the grade of the temporary resurfacing utilizing either cement mortar or bituminous concrete to hold the frame in place. A slope, constructed of bituminous concrete pavement, shall be placed around the entire grate, frame and cover for a distance of 6 inches from the grate, frame and cover.

C. Any voids created in the road gravel or pavement when raising the grate, frame and cover from its temporary elevation to its permanent elevation shall be filled with concrete.

3.03 DROP CONNECTIONS

A. Drop connections shall be installed for manholes, which have invert elevation differences greater than 3-feet. No exterior drop connections are allowed.

B. Drop connections for manholes shall be constructed utilizing polyvinyl chloride pipe, elastomeric sealed joints, and Type 316 stainless steel mounting hardware and materials. Drops shall be constructed in accordance with the Contract Drawings.

C. The size of the drop piping shall be 8 inches when the size of the sewer main is less than 24 inches. When the sewer main is equal to or larger than 24 inches, the drop piping shall be 12 inches in diameter.

3.04 LEAKAGE TESTS

A. Leakage tests shall be made and observed by the Engineer on each sewer manhole. The test shall be an exfiltration, infiltration test or vacuum test made as described below:

1. Preparation for Testing

   a. After the manhole has been assembled in place, all lifting holes and horizontal joints shall be filled and pointed with a non-shrinking mortar. The test shall be made prior to placing the tables and invert and before filling and pointing the horizontal joints.

   b. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged and plugs braced to prevent blow out.

2. Backfilling

   a. The test may be conducted before backfilling around the manhole.

   b. There will be adjustment in the leakage allowance for unknown causes including, but limited to, leaking plugs and absorption. It will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete.

3. The Contractor has the option of test method depending upon the actual field conditions. The following are acceptable test methods:

   a. If the measured ground water table is above the highest joint in the manhole, and if there is not leakage into the manhole as determined by the Engineer, the Contractor may perform an infiltration or vacuum test as described herein.

   b. If the measured ground water table height is lower than the invert of the manhole, the Contractor may perform an exfiltration or a vacuum test.

3.05 TEST PROCEDURES

A. Infiltration Test

1. The manhole interior shall be visually inspected. The manhole shall be considered acceptable for use when no infiltration of ground water is observed on the interior surfaces of the manhole.

B. Exfiltration Test

1. The manhole shall be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole shall be considered satisfactorily watertight.

2. If the test as described above is unsatisfactory as determined by the Engineer of if the manhole excavation has been backfilled the test shall be continued. A period of time may be permitted, if the Contractor so wishes, to allow for absorption.

3. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and the measuring time of at least 8 hours shall begin. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed 1 gallon per vertical foot for a 24-hour period.

4. If the test fails, but the leakage does not exceed 3 gallons per vertical foot per day, repairs shall be made in accordance with industry standard repair methods as to bring the leakage within the allowable rate of 1 gallon per vertical foot per day. It shall be the Contractor's responsibility to uncover the manhole as necessary and to disassemble, reconstruct or replace it as required, at no cost to the Owner. The manhole shall then be retested.

C. Vacuum Test

1. If the vacuum test is performed in lieu of the infiltration or exfiltration test the Contractor shall take any and all steps necessary to assure the Engineer that the water table is below the invert of the manhole throughout the test. Any and all measures necessary by the Contractor to lower the ground water table below the invert of the manhole will be at the Contractor's expense. The vacuum test shall be based on the following criteria:

a. Manhole test pressures and time shall be as follows:

(1) Initial test pressure, 10 inches Hg (i.e., 20 inch absolute).

(2) Test time, 1 inch Hg drop to 9 inch Hg in 2 minutes minimum allowable, for 0 to 10 foot deep manholes; 2-1/2 minutes minimum allowable for 10 foot to 15 foot deep manholes; 3 minutes minimum allowable for manholes greater than 15 foot in depth.

b. If the pressure drop exceeds 1 inch Hg in 2 minutes the manhole shall be repaired and retested.

c. If a manhole fails to meet a 1-inch Hg drop in 1 minute after repair, the manhole shall be water exfiltration tested and repaired as necessary.

d. Testing using either air or water shall be done whenever possible prior to backfilling to assist in locating leaks. Joint repairs by parging are to be done on both outside and inside of the joint to ensure a permanent seal. Vacuum testing draws together the joint and applies high pressure to the elastomeric joint material. Properly placed and sized elastomeric joint material must be used to avoid leakage or to enable sections to be separated if necessary to effect a repair.

3.06 MANHOLE ENCAPSULATION SYSTEM

A. The external manhole encapsulation system shall be installed in accordance with the manufacturer’s written instructions. All surfaces shall be free of dirt, sharp points and preheated to remove moisture.

B. The Contractor’s personnel shall be trained by the manufacturer in the proper method of application of the external manhole encapsulation system. The Contractor shall have the manufacturer’s field service representative present during the application of external manhole encapsulation system on the first two manholes encapsulated.

3.07 MANHOLE ADJUSTING RINGS

A. The manhole adjusting rings shall be installed in accordance with the manufacturer's written instructions.

B. The Contractor's personnel shall be trained by the manufacturer in the proper method of application of the external manhole encapsulation system. The Contractor shall have the manufacturer's field service representative present during the installation of the manhole adjusting rings on the first two manholes where adjusting rings are installed.

3.08 VISUAL INSPECTION

A. At the conclusion of the work, all manholes, catch basins, handholes and pull boxes shall be visually inspected by the Engineer to insure a straight and plumb alignment.

B. All manholes, catch basins, handholes and pull boxes that are not straight and plumb shall be removed and replaced.

3.09 CLEANUP

A. Upon completion, of all construction and testing, and prior to final acceptance all debris shall be removed from manholes and the tables cleaned.

END OF SECTION

SECTION 02735

FLOW CONTROL OF SEWER LINES

PART 1 GENERAL

1.01 SCOPE

A. The Work of this section includes furnishing all labor, materials, tools and equipment necessary to control the flow of wastewater in the sewer lines.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section shall be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals shall include shop drawings showing complete fabrication and construction details, materials, weights, dimensions, clearances, anchorage details, piping and utility requirements. Submittals shall include at least the following:

1. Contractor's description of all equipment to be used.

2. Contractor's description of his proposed methodology.

1.05 PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer’s written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

1.06 DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. Contractor shall use by-pass pumps and power sources with sound proofing for minimal disturbance (less than 85 db).

C. Contractor shall provide secondary containment for any type of fuel used for power sources. Secondary containment shall sized for at least 150 percent of the total fuel supply.

PART 2 PRODUCTS - Not Applicable.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. When the depth of flow in the sewer line is above the maximum allowable set forth for the type of work being performed in the applicable section(s) of these specifications, one or more of the following methods of flow control shall be used:

1. Plugging or Blocking

a. A sewer line plug shall be inserted into the sewer line(s) at a manhole upstream from the section in which the work is to be performed.

b. The plug shall be so designed that all or any portion of the sewage flow can be released.

2. Pumping and Bypassing

a. When pumping/bypassing is required, the Contractor shall supply the necessary pumps, conduits and other equipment to divert the flow of sewage around the section in which work is to be performed. The Contractor shall be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system.

b. Bypass pumping shall only be performed during working hours. The gravity sewers shall be reconnected at the end of each work day.

B. The Contractor shall conduct its work so as to not cause excessive surcharging of the sewerage system and shall not cause damage to the sewerage system, its connections and/or apparatus. Any damage caused by the Contractor's operations shall be repaired to the complete satisfaction of the Engineer and at no additional cost to the Owner.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer’s written instructions and in accordance with applicable codes, rules and regulations.

3.04 PAINTING – Not Used

3.05 CLEAN UP

A. The Contractor shall be responsible for the legal disposal of removed materials and general clean-up of the work area as approved by the Engineer.

3.06 MANUFACTURER'S FIELD SERVICES – Not Used

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used

3.09 SPARE PARTS – Not Used

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 03310

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SCOPE

A. The Work of this section includes all labor, materials, tools, and equipment required for the furnishing of all materials required for concrete Work and, where appropriate, applying or installing such materials for the various items of concrete Work as shown on the Contract Drawings and/or as specified herein and evidently required.

B. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with the provisions of DOCUMENT 00700, GENERAL CONDITIONS and SECTION 01300, SUBMITTALS. In addition, alls submittals shall meet the requirements of ACI 301.

B. Submittals required under this section include, but are not limited to the following:

1. Certified mill reports of cement.

2. Fine and coarse aggregate data, including sieve analyses, potential alkali reactivity, and soundness from tests performed as specified in this section for all aggregates proposed for use. Aggregate, tested in accordance with ASTM C1260, having a fourteen (14) day expansion greater than 0.10 percent shall be considered to be potentially reactive. Test data of organic impurities for fine aggregate.

3. Brochures and technical data for at least the following items:

a. Admixtures, each type.

4. Reports

a. Test data supporting proportions of design mixes, for each different contemplated application, based upon laboratory trial batches or field test records that are in strict accordance with ACI-301, “Specifications for Structural Concrete”, Section 4, “Concrete Mixtures”. Field test data used to determine the standard deviation used for establishing the required average design strength shall be from within the previous twelve (12) months, in accordance with ACI-301. Field test data documenting that the proposed concrete proportions will produce an average compressive strength equal to or greater than the required average compressive strength shall be from within the past twenty-four (24) months. Such data shall be submitted to the Engineer within forty-five (45) days after Notice to Proceed, or at least fourteen (14) days before initial placement of concrete, whichever date is earlier. Data shall include source of cement and aggregates.

b. Fly ash source and test reports showing fly ash to be in compliance with these Specifications. Reports shall be for actual fly ash to be used in the Work.

c. Ground granulated blast-furnace slag source and test reports showing slag to be in compliance with these Specifications. Reports shall be for actual slag to be used in the Work.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. It is intended that the major portion of the concrete be supplied from a commercial ready mix plant capable of meeting the following requirements for storage and handling of materials. Where no such plant exists within a reasonable distance from the site, and for small amounts of concrete which may be site mixed, the following requirements shall apply.

1. Cement shall be carefully stored immediately upon receipt. Cement in sacks shall be stored in a suitable weatherproof structure that shall be as airtight as practical to prevent the absorption of moisture. Sacks shall be stacked as close together to reduce circulation of air but shall not be stacked against outside walls. The manner of storage shall permit easy access for inspection and identification of each shipment. Bulk cement shall be transferred to elevated airtight and weatherproof bins. At the time of use, all cement that has been in storage so long that there is doubt of its quality will be tested by standard mortar to determine its suitability for use, and such cement shall not be used without approval.

2. Aggregates shall be stored in a manner that will preclude the inclusion of foreign material. Aggregates of different sizes shall be stored in separate piles. Stockpiles of coarse aggregate shall be built in horizontal layers not exceeding four feet in depth to avoid segregation.

1.06 DESIGN CRITERIA

A. The materials and equipment specified are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's written recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

B. Comply with ACI 301, "Specification for Structural Concrete," including the following sections, unless modified by requirements in the Contract Documents:

1. "General Requirements."

2. "Formwork and Formwork Accessories."

3. "Reinforcement and Reinforcement Supports."

4. "Concrete Mixtures."

5. "Handling, Placing, and Constructing."

C. Approvals

1. Commencement of Work. Concrete Work shall not begin until test results and design mixes have been reviewed by the Engineer. The Engineer's review does not constitute "approval"; the Contractor shall be responsible for meeting all concrete performance requirements.

2. Mix Variations. The Engineer reserves the right to vary in the field any previously approved design mix so as to compensate for field variables including but not limited to weather conditions, placing conditions, variations in size, gradation or characteristics of aggregate and end use of the concrete.

1.07 REFERENCED SPECIFICATIONS, CODES, AND STANDARDS

A. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials".

B. ACI 301, "Specifications for Structural Concrete".

C. ASTM C31, "Standard Practice for Making and Curing Concrete Test Specimens in the Field".

D. ASTM C33, "Standard Specification for Concrete Aggregates".

E. ASTM C40, "Standard Test Method for Organic Impurities in Fine Aggregates for Concrete".

F. ASTM C88, "Standard Test Method for Soundness of Aggregate by use of Sodium Sulfate or Magnesium Sulfate".

G. ASTM C94, "Standard Specification for Ready-Mixed Concrete".

H. ASTM C143, "Standard Test Method for Slump of Hydraulic-Cement Concrete".

I. ASTM C150, "Standard Specification for Portland Cement".

J. ASTM C173, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method".

K. ASTM C494, "Standard Specification for Chemical Admixtures for Concrete".

L. ASTM C618, "Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete".

M. ASTM C989, "Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars".

N. ASTM C1260, "Standard Test Method for Potential Alkali Reactivity of Aggregate (Mortar-Bar Method)".

O. ASTM C1602, "Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete".

P. ASTM E329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction".

PART 2 PRODUCTS

2.01 FORMWORK

A. Furnish formwork and formwork accessories according to ACI 301.

2.02 STEEL REINFORCEMENT

A. Select requirements from this Article or revise to suit Project.

B. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.03 CONCRETE MATERIALS

A. General

1. All concrete shall be designed to have a minimum 28-day compressive strength of 5,000 pounds per square inch, except as otherwise noted in the Contract Documents.

2. The proportions of aggregate to cement shall be such as to produce a mixture of the required strength which will work readily into the corners and angles of the forms and around reinforcement and that will produce finishes acceptable to the Engineer, but without permitting the materials to segregate.

B. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, as approved by the Engineer, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II Supplement with the following:

a. Fly Ash: ASTM C 618, Class F.

b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

C. Aggregate

1. All aggregates shall conform to the standard specifications for Concrete Aggregates, ASTM C33 as amended by the specification. Aggregates failing to meet these specifications but proved by special test or actual service to produce concrete of the required quality may be used where authorized by the Engineer.

2. Fine Aggregates

   a. Fine aggregates shall consist of sand or screenings of gravel or crushed stone, well graded from fine to coarse; clean and free from soft particles, clay, loam or organic matter, with the volume removed by sedimentation not more than three percent. When tested in accordance with ASTM C40 for organic impurities, the color of the supernatant liquid above the test sample shall show not darker than organic plate No. 3.

   b. Fine aggregate shall conform to the following grading:

U.S. Standard Sieve	Percent Passing
Size 3/8 inch	100
No. 4	95 - 100
No. 8	80 - 100
No. 16	50 - 85
No. 30	25 - 60
No. 50	5 -30
No. 100	0-10

   c. Fine aggregate shall not have more than 45 percent retained between any two consecutive sieves of those listed above, and its fineness modulus shall not be less than 2.3 nor more than 3.1. If the fineness modulus varies by more than 0.20 from the value assumed in selecting proportions for concrete, the fine aggregate shall be rejected unless suitable adjustments are made in concrete proportions to compensate for the difference in grading.

3. Coarse Aggregates

   a. Coarse aggregates shall consist of crushed stone or washed gravel having clean, hard, durable, uncoated particles, free from dust, dirt, or other deleterious substances; and free from thin, flat or elongated particles. Maximum aggregate size shall be 1 ½ inch for all slabs poured on ground, foundation mats, and footings, in addition to walls that are at least 15 inches thick, except where the clear spacing between reinforcing bars is less than 2 inches. Maximum aggregate size shall be ¾ inch at all other locations, except as specified elsewhere or upon written approval of the Engineer.

   b. Coarse aggregate shall conform to the grading given in Table 2 of ASTM C33 for sizes No. 467, 57, 67, 7, and 8.

D. Water. Water shall be clean, fresh and free from oil, acid, salt, alkali, sewage, organic matter, and other deleterious substances. Water shall conform to ASTM C 94.

E. Admixtures. Admixtures shall be used as follows: The use of products other than those named herein will be allowed only with the written approval of the Engineer. All admixtures used with concrete that will be in contact with potable water shall be NSF approved.

   1. Air Entraining Agent. The air-entraining admixture shall be chloride free, conforming to ASTM C260.

2. Mid-Range Water Reducing Agents. Except when otherwise ordered by the Engineer or noted elsewhere herein, all normal structural concrete shall have a water reducing agent added. The admixture shall conform to ASTM C494, Type A or B. The air entraining action of the water reducing agent shall be taken into account and the air-entraining agent limited accordingly.

3. Water Reducing-Retarding Agents. When the ambient temperature rises above 70 degrees F., the water reducing agent shall be replaced in whole or in part with a water reducing-retarding agent conforming to ASTM C494, Type D. The admixture shall be used in such amounts as will produce concrete with a set time equal to that which it would have at 70 degrees F. without the retarder.

4. Superplasticizer. Superplasticizing admixtures used to produce flowing concrete may be approved for use in concrete in any part of the structure. Product shall conform to ASTM C494, Type F or G. Admixture may be plant added or field added for best application depending on haul time and ambient temperatures.

5. Fly Ash. Fly Ash shall conform to the following.

   a. ASTM C618, Class F.

   b. Maximum loss of ignition: 3.0 percent.

6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

7. Ground Granulated Blast Furnace Slag. Ground-granulated blast furnace slag shall conform to the following.

   a. ASTM C 989.

   b. Slag activity classification: Grade 100 or 120.

2.04 RELATED MATERIALS

A. Vapor Retarder: Multi-ply reinforced polyethylene sheet, ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.05 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.06 CONCRETE MIXTURES

A. Comply with ACI 301 requirements for concrete mixtures.

B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:

1. Minimum Compressive Strength: 5,000 psi at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.40 .

3. Slump Limit: 7 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

4. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of floor slabs to receive troweled finishes to exceed 3 percent.

C. Fly Ash. Use of fly ash is optional. Combine fly ash with cement at rate of 1.0 pound of fly ash per pound reduction of cement. When used, the amount of fly ash shall not be less than 15 percent, nor more than 25 percent of weight of cement plus fly ash.

D. Ground Granulated Blast-Furnace Slag (GGBF Slag): GGBF slag use is optional. Combine GGBF slag with cement at rate of 1.0 pound of slag per pound reduction of cement. When used, the amount of slag shall not be less than 25 percent nor more than 50 percent of weight of cementitious material.

E. Fly Ash and GGBF Slag: The combined use of fly ash and GGBF slag is optional. When used, the minimum amount of Portland cement shall be 337 lb per cubic yard of concrete. The total replacement of cement with fly ash and GGBF slag shall not exceed 50 percent, and the total replacement of cement with fly ash shall not exceed 25 percent.

2.07 CONCRETE MIXING

A. Ready-Mixed Concrete

1. Measure, batch, mix, and deliver concrete according to ASTM C 94 and furnish batch ticket information.

2. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing

1. Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

2. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

3. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.

4. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record the approximate location of final deposit in structure.

PART 3 EXECUTION

3.01 TESTING AND INSPECTION

A. General

1. Concrete materials and operations shall be tested and inspected as the work progresses. Failure to detect any defective work or material shall not in any way preclude later rejection when such defect is discovered nor shall it obligate the Engineer for final acceptance.

2. The use of testing services shall in no way relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

B. Responsibilities and duties of General Contractor:

1. Design Concrete Mixes.

a. Concrete mixes shall be designed in accordance with Section 4, “Concrete Mixtures” of ACI 301, “Specifications for Structural Concrete”.

b. Ingredient Tests. Prior to making design mixes, the Testing Laboratory conforming to ASTM E329 and subject to the approval of the Engineer shall conduct the following tests in accordance with the procedures referred to in the applicable Reference Standards, cited herein, to assure conformance with the applicable Specifications:

(1) Cement: Specific gravity and brand name of cement.

(2) Aggregates: Sieve analysis, specific gravity, soundness, percentage of voids, absorption, potential alkali reactivity, moisture content of fine and coarse aggregate, dry-rodded weight of coarse aggregate, and fineness modulus of fine aggregate.

c. Design mixes shall indicate water-cement ratio, cement factor, water content, admixture content, cement content, aggregate content, aggregate gradations, slump, air content and strength. Design mixes and related tests shall be in accordance with the procedures referred to in the applicable reference specifications cited herein.

d. The testing laboratory shall recommend as determined by trial mixes and strength curves, the design mixes to be used for each application of concrete that will produce concrete of specified strengths and finishes with slumps and workability to meet all placing conditions.

2. Furnish necessary labor to assist the testing laboratory and Engineer in obtaining and handling samples at the Project or other sources of materials.

3. Advise the testing laboratory and the field observers at least twenty-four (24) hours in advance of placing concrete to allow for completion of quality tests and for the assignment of personnel.

4. Provide and maintain adequate facilities for safe storage and proper curing of concrete test specimens on the project site for 48 hours after casting, as required by ASTM C31. Cylinders shall be stored in a temperature range from 60 to 80˚F and in an environment preventing moisture loss from the specimens. Various procedures are capable of being used during the initial curing period to maintain the specified moisture and temperature conditions, and appropriate procedures shall be used. Examples of such procedures include immediate immersion of molded specimens with plastic lids in water saturated with calcium hydroxide (except that cardboard and other molds that expand when immersed in water should not be used), storage in wooden boxes, placement in damp sand pits, etc. All specimens shall be shielded from direct sunlight and, if used, radiant heating devices. The storage temperature shall be controlled by use of heating and cooling devices, if necessary. Record the temperature using a maximum-minimum thermometer.

5. Direct the testing laboratory to conduct additional tests on concrete ingredients and make new design mixes whenever the character or source of ingredients is changed or if the placed concrete fails to meet the specified strengths at no additional cost to the Owner.

3.02 FORMWORK

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

B. Chamfer exterior corners and edges of permanently exposed concrete.

3.03 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.04 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Locate and install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints

1. Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

2. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.05 CONCRETE PLACEMENT

A. Comply with ACI 301 for measuring, batching, mixing, transporting, and placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Do not add water to concrete during delivery, at Project site, or during placement.

D. Consolidate concrete with mechanical vibrating equipment.

3.06 FINISHING FORMED SURFACES

A. Smooth-Formed Finish

1. 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.

2. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

B. Rubbed Finish: Apply the following rubbed finish, defined in ACI 301, to smooth-formed finished as-cast concrete where indicated:

1. Smooth-rubbed finish.

2. Grout-cleaned finish.

3. Cork-floated finish.

C. 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.

3.07 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface. Do not further disturb surfaces before starting finishing operations.

C. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-applied membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to slab surfaces exposed to view.

E. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.08 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to 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. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days 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.

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.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

B. Tests: Perform according to ACI 301.

1. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Testing Frequency: One composite sample shall be obtained for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

3.10 REPAIRS

A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION

SECTION 09900

PAINTING

PART 1 GENERAL

1.01 SCOPE

A. The Work of this section includes all labor, materials, tools, scaffolding, and equipment whether of a permanent or temporary nature, and all operations necessary and required in connection with painting and finishing of all surfaces and items as indicated on the Drawings, as specified herein, or as evidently required to complete the Work.

B. Objective. It is not the objective of this specification to name every item requiring a painter's finish. Where items are noted, it is intended that all items of a similar material shall have the same decorative or protective coating within the same space or use area of the facility. Where existing rooms or areas are noted in the Finish Schedule as being painted, it is the intent to paint both new and existing items listed below which are in those rooms or areas. In rooms or areas which are not noted in the Finish Schedule as being painted, only new items will require painting. As a guide to the Contractor, the following list is given as typical of the items and surfaces requiring a painter’s finish. As a guide to the Contractor, the following list is given as typical of the items and surfaces requiring a painter's finish.

1. All motors, drives, guards, pumps, bases, mechanical and process equipment and similar items.

2. All interior and exterior pipe, fittings, valves and accessories exposed-to-view.

3. Steel stacks, vents, and pipes, above and below roof levels.

4. Miscellaneous ferrous metal and all other incidental ferrous metal items not specifically excluded.

5. Monorails, hoists, and supports, and other material handling equipment.

6. Piping supports and restraints.

7. Electrical conduit, and junction boxes, fans, and unit heaters (interior and exterior).

8. Ferrous metal (interior and exterior) including doors and frames.

9. Non-ferrous metal (interior and exterior).

10. Plywood backer panels

11. Safety Identification Locations

12. Concrete (Floors, Ceilings and Walls)

    a. Wet Well

    b. Valve Vault

    d. Special Manholes

13. Concrete (Ceilings and Walls)

    a. Generator Building

C. The work of this section includes cleaning, including pressure washing, sand blasting, clean water rinse and the like, preparing all surfaces required to be painted.

D. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings and brochures shall be submitted for all items to be furnished in accordance with provisions of DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Complete listing of all products intended for use, indicating the surfaces and areas for each product, and stating the number of coats and the dry film thickness (DFT) of each coat.

2. Product Data Sheets including compliance with National Sanitary Foundation (NSF) approvals, when materials are to be used for potable water systems.

3. Performance criteria indicating the proposed coating meets or exceeds latest ASTM test requirements for abrasion resistance, chemical resistance, adhesion and accelerated weathering.

4. Color chip books showing the manufacturers complete line of color selections identifying the colors to be utilized on the project.

C. Submittal shall be submitted for approval at least 90 days prior to purchasing and applying any paint.

1.05 PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed according to the manufacturer’s written recommendations.

B. The materials and equipment shall be stored on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

1.06 DESIGN CRITERIA

A. Examine the Specifications and the Drawings for the various trades with regards to requirements for painting and finishing items of Work. Understand that the Painting Contractor shall paint all materials and equipment throughout the Work which obviously require a painter’s finish and are left unfinished by others.

B. No colors containing lead in excess of 0.5 percent in the dried film shall be used.

C. All coatings shall comply with air pollution regulations and shall limit volatile organic compounds (V.O.C.) to a maximum of 340 grams per liter or 2.8 pounds per gallon.

D. All coating and surface treatment applied materials partially or fully submerged in potable water shall meet NSF Standard 61.

E. Contractor shall provide a barrier coat as follows:

1. All new materials and equipment which has a shop primer.

1.07 COLOR SELECTIONS

A. Subsequent to submittal and approval of the painting system, the Engineer will prepare and forward to the Contractor a list of all the color choices for paints and finishes to be incorporated on the Project.

B. Interior piping and equipment exposed to view shall be color coded. Table I indicates the base colors and identifying bands which have been selected for this project. Table II attached to this section stipulates the manufacturer's paint number and name.

PART 2 PRODUCTS

2.01 GENERAL

A. Except as noted, materials are designated herein by reference to Tnemec trade names and numbers to establish the type and quality required. Such designations are not restricted except as to type and quality.

B. Similar and equal products as manufactured by Sherwin Williams, PPG, Carboline, Dupont or Protective Flooring & Linings, A Division of A.W. Chesterton Company will be given consideration as a substitute.

2.02 PAINTS AND FINISHES

A. Interior Surfaces

1. Ferrous Metal Surfaces (Polyamidoamine Epoxy)

1st Coat	Tnemec Series 90-97 Tnemec-Zinc	Note: Ferrous metal with a shop primer may require a barrier coat. If primer is compatible omit first coat.
2nd Coat	Tnemec Series N69 H.B. Epoxoline II	
3rd Coat	Tnemec Series N69 H.B. Epoxoline II	

2. Non-Ferrous Metals (Polyamidoamine Epoxy)

1st Coat	Tnemec Series N69
	H.B. Epoxoline II
2nd Coat	Tnemec Series N69
	H.B. Epoxoline II

3. Interior Concrete (Polyamidoamine Epoxy)

1st Coat	Tnemec Series 130
	Envirofill
2nd Coat	Tnemec Series N69
	H.B. Epoxoline II
3rd Coat	Tnemec Series N69
	H.B. Epoxoline II

5. Plastic Piping and Components (Polyamidoamine Epoxy)

1st Coat	Tnemec Series N69
	H.B. Epoxoline II
2nd Coat	Tnemec Series N69
	H.B. Epoxoline II

6. Pipe Insulation Cover (Polyamidoamine Epoxy)

1st Coat	Tnemec Series 151
	Elasto-Grip
2nd Coat	Tnemec Series N69
	H.B. Epoxoline II
3rd Coat	Tnemec Series N69
	H.B. Epoxoline II

7. Hot Ferrous Metal Surfaces over 350 degree F (Silicone)

1st Coat	Tnemec Series 39
	Silicone Aluminum
2nd Coat	Tnemec Series 39
	Silicone Aluminum

B. Immersion Service (Includes all Surfaces of Interior and Exterior Items Partially or Fully Submerged.)

1. Ferrous Metal Surfaces (100% Solids Modified Amine Epoxy)

1st Coat	Tnemec Omnithane	3 mils DFT
2nd Coat	Tnemec Series 446	7 mils DFT
	Perma-Shield	
3rd Coat	Tnemec Series 446	7 mils DFT
	Perma-Shield	

2. Concrete (100% Solids Modified Amine Epoxy)

1st Coat	Tnemec Series 218/219	Full Parge coat at 1/8-inch thickness
	Mortar-Clad Surface	
2nd Coat	Tnemec Series 435	15-20 mils DFT
	Perma-Shield	
3rd Coat	Tnemec Series 435	15-20 mils DFT
	Perma-Shield	

C. Exterior Surfaces (High Build Acrylic Polyurethane Enamel)

1. Ferrous Metal Surfaces

1st Coat	Tnemec Series 90-1K 97
	Tnemec-Zinc
2nd Coat	Tnemec Series N69
	H.B. Epoxoline II
3rd Coat	Tnemec Series 1075
	Endura-Shield IV

2. Non-Ferrous Metals and Fiberglass Surfaces

1st Coat	Tnemec Series N69
	H.B. Epoxoline II
2nd Coat	Tnemec Series 1075
	Endura-Shield IV

D. Interior and Exterior Wood Trim (Acrylic Enamel)

1st Coat	Tnemec Series 151 Elasto-Grip
2nd Coat	Tnemec Series 1029 Enduratone
3rd Coat	Tnemec Series 1029 Enduratone

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Notify other subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 APPLICATION

A. All paints and coatings shall be applied strictly in accordance with the manufacturer's instructions with regard to surface preparation, pretreatments, mixing and thinning, temperature of material and substrate, mill thickness, curing or drying times before recoating, and all similar recommendations.

B. Abraded areas of shop primed items and unprimed items shall be cleaned and primed with a paint as specified herein. Masonry and concrete surfaces shall be primed as specified herein. Where coatings containing strong solvents, such as epoxies, are specified, primers shall be compatible with finish coats or special barrier coats shall be used.

C. Ferrous Metal Painting. All steel or other ferrous metal which will be exposed-to-view upon completion of the work, shall have prime coats either shop or field applied, and finish coats as specified. Steel in submerged service whether or not exposed-to-view shall have both prime and finish coats. Steel that will be concealed by other construction shall require priming or the repair of shop prime coats only.

D. Concrete. Generally, all interior concrete exposed-to-view in non-submerged service shall be painted except for floors and stair treads.

E. New mechanical equipment and other items prefinished in the shop by the fabricators will require only field finish coats for system code color compatibility, and specified mil thickness. Barrier coats, if required will be the responsibility of the Contractor.

F. Isolation of Aluminum. Where aluminum items are to be used in conjunction with masonry, treated wood or more noble metals, direct contact between the two materials shall be prevented by painting the contact surfaces with bituminous paint.

G. Unless otherwise noted interior and exterior exposed aluminum shall not require painting other than for isolation as specified.

H. Stainless steel shall not require field finishes.

I. Equipment specified as having a factory prime coat only, shall be field finish painted under this section of the Specifications.

J. Coating shall be applied sufficiently to achieve no less than the minimum dry mil thickness per coat for each coat, recommended by the paint manufacturer. On surfaces where it is impractical to determine dry film thickness, spreading rates per unit measure will be considered. If on any surface, complete coverage is not achieved with the number of coats specified and thickness as recommended by the manufacturer, additional coats shall be applied at no additional expense to the Owner.

K. No painting shall be done when temperatures are below 50° F., when the surface temperature is less than 5° F. above the dew point or when the relative humidity is above 85 percent. No open flame heaters shall be used during the painting Work.

L. All concrete and Concrete Masonry Unit (CMU) surfaces that are to be painted shall receive the first coat of paint prior to the installation of equipment specified under other sections including, but not limited to mechanical equipment, electrical equipment, piping, ductwork, and conduit.

M. All process and other piping to be painted shall be finish painted prior to the piping being placed into service including the testing of the pipeline.

N. Wood work shall be primed as soon as it is delivered to the Project Site. Surfaces that will be concealed after installation shall be sealed with one coat of primer. Sap spots or knots shall be washed with mineral spirits and sealed with an approved sealer.

3.03 SURFACE PREPARATION

A. Prepare surfaces to receive Work of this Section in strict accordance with manufacturer's instructions applicable to each material, condition, and finish. All steel surfaces shall be primed the same day as cleaned.

B. Field-Welded Ferrous Metal: After installation, field-welding, and grinding, and immediately before painting, remove rust, loose mill scale, dirt, weld flux, weld spatter, weld smoke stains, burnt primer, and other foreign material with wire brushes and/or steel scrapers. Power tool clean in accordance with the Steel Structures Painting Council (SSPC) SP 3. Remove grease and oil by use of solvent recommended by paint manufacturer. Sand exposed surfaces, and between coats, as required to produce smooth, even finishes. Sand smooth and spot prime welded areas, and areas where prime coat has been damaged or abraded, using rust inhibitive primer scheduled in this Section.

C. Ferrous Metal: Remove rust, mill scale, and foreign materials. Wire brush or sand damaged or rusted area to bright metal. Remove grease or dirt with solvents recommended by paint manufacturer just prior to applying paint. Spot prime all areas where shop coat has been damaged or abraded, using same type paint as used for shop coat.

D. Field-Welded Galvanized Metal: After installation, field-welding, and grinding, and immediately before painting, remove rust, loose mill scale, dirt, weld flux, weld spatter, weld smoke stains, and other foreign material with wire brushes and/or steel scrapers. Power tool clean in accordance with SSPC SP 3. Remove grease and oil with solvents recommended by paint manufacturer. Sand exposed surfaces, and between coats, as required to produce smooth, even finishes. Sand smooth welded areas, and areas where galvanized coating has been damaged abraded. Spot prime using zinc primer scheduled in this Section.

E. Other Galvanized Metal: Prior to installation, remove corrosion and foreign materials by sanding or other appropriate method. Remove grease or dirt with solvent recommended by paint manufacturer just prior to applying primer.

F. Existing Submerged Concrete and CMU Surfaces (including splash areas and surfaces subjected to H_2S exposure).

1. Remove existing coatings and contaminated concrete in accordance with SSPC SP #13 Standard. Provide surface profile in accordance with ICRI CSP 5-8.

2. Prior to coating, test pH of cleaned surfaces. pH shall be a minimum 9 and maximum 11. Remove additional concrete should pH be below required levels.

3. Verify dryness of cleaned concrete by testing for moisture per ASTM D 4263. Large voids, bugholes and other cavities shall be filled with specified filler and/or surfacer prior to coating.

G. Surface preparation for non-ferrous metals shall consist of a solvent wipe to remove grease and dirt followed by rinsing with clean water and any pretreatments specified. Solvent Clean Surfaces shall be as per SSPC-SP#1.

H. Surface preparation for plastics will depend on the surface to be cleaned, and shall conform to industry recommended methods. Any glazed surface shall be roughened with emery cloth.

I. Materials Preparation: Mix and prepare paint materials in accordance with manufacturer's printed instructions. Use only thinners approved by paint manufacturer, and only within recommended limits.

3.04 GUARANTEE

A. Guarantee workmanship and that the products used will adhere to surfaces without peeling and cracking, scaling, alligatoring, blistering, or fading for a period of at least one year from the date of final acceptance of the painting Work. Upon written notice of paint failure by any of the above, or similar reasons, prepare and repaint failed surfaces without additional cost to the Owner. If it is determined that the product chosen was faulty, the Contractor shall still have the obligation of removing and replacing the coating without further expense to the Owner.

B. Should the Contractor have any reservation that the product specified will not perform as intended, it shall so notify the Engineer and shall not proceed with that Work until agreement is reached on mutually acceptable products.

3.05 HOLIDAY TESTING

A. The Owner reserves the right to require holiday testing. Recoat any thin spot detected or make other repairs as a part of the Work at no additional cost to the Owner.

3.06 CLEANUP

A. Clean and remove all solvents, paint cans, and other materials from the Project Site. All paint drips, spatters, over spray and spills on all surfaces, materials, and equipment exposed to view shall be removed or sanded smooth and repainted.

B. All excess material shall be legally disposed.

END OF TEXT

SEE ATTACHED TABLES

TABLE I - PIPING COLOR CODE

TABLE II - COLOR NUMBERS

TABLE I

PIPING AND EQUIPMENT COLOR CODE

Service	Color
Drain	Black
Gas	Orange
Concrete	White
Plumbing Vents	Gray
Roof Drains	Gray
Safety Identification Areas	Yellow
Sanitary Drains	Gray
Town Water (Potable)	Blue
Wastewater Piping	Brown

TABLE II

COLOR NUMBERS

Colors	Tnemec Color Number
Black	IN06 Black
Blue	SC06 Safety Blue
Brown	YB12 Kodiak
Gray	IN01 Light Gray
Orange	SC03 Safety Orange
Yellow	SC01 Safety Yellow
White	WH01 White

END OF SECTION

SECTION 11300

SUBMERSIBLE WASTEWATER PUMPING STATION

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, materials, tools and equipment necessary to furnish and install one (1) submersible wastewater pumping station as specified herein and as shown on the Contract Drawings.

B. All electrical work shall be performed by a licensed electrician. All electrical work shall conform to all applicable codes in addition to what is specified herein.

C. Attention is directed to the other sections in DIVISION 11, and all sections within DIVISION 9, DIVISION 15, and DIVISION 16 which are hereby made a part of this section of the Specifications.

D. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop drawings, brochures and samples shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700 - GENERAL CONDITIONS.

B. Submittals required with the section, but are not limited to the following:

1. Shop Drawings, including all equipment and components.

2. Data regarding pump and motor characteristics and performance:

a. Prior to fabrication and testing, provide manufacturer’s guaranteed performance curves based on actual shop tests of mechanically duplicate pumps, showing they meet indicated and specified requirements for head, capacity, horsepower, efficiency and NPSHr.

(1.) For units of same size and type, provide curves for a single unit only.

(2.) Provide catalog performance curves at maximum pump speed indicated and specified for each service showing maximum and minimum impeller diameters available, acceptable operating range (AOR) and preferred operating range (POR).

(3.) Results of shop performance tests as specified.

(4.) Submit curves for manufacturer’s guaranteed performance, and shop performance tests on 8-1/2-inch by 11-inch (A4) sheets, one curve per sheet.

3. Shop drawing data for accessory items.

4. Certified setting plans, with tolerances, for anchor bolts.

5. Manufacturer’s brochures and/or catalog cuts for all materials and equipment.

6. Complete master wiring diagrams and elementary or control schematics, including required coordination with other electrical control devices operating in conjunction with the pumping station. It is imperative the above drawings be clear and carefully prepared to facilitate interconnections with other equipment. Standard preprinted sheets or drawings simply marked to indicate applicability to this contract will not be acceptable.

7. Structural design calculations and anti-buoyancy calculations sealed by a professional engineer registered in the Commonwealth of Massachusetts

8. Operation and Maintenance Manual of pumping station including all equipment and components.

1.05 PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability or appearance. The equipment shall be stored in a clean, dry location free from construction dust, precipitation and excess moisture.

B. If stored for more than two weeks, the equipment shall receive all maintenance considerations required by the manufacturer for proper storage of the equipment.

1.06 DESIGN CRITERIA

A. The materials and equipment covered by this specification are intended to be standard materials and equipment of proven ability as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment. All work shall conform to the requirements of SECTION 01640, SPECIAL MECHANICAL AND ELECTRICAL EQUIPMENT REQUIREMENTS.

B. All pumping equipment shall be provided by the same manufacturer. The Owner has standardized on pumping equipment as manufactured by manufactured by Xylem, Inc. (Flygt). No substitutions are allowed.

1.07 WARRANTY

A. Pump manufacturer shall warrantee the pumps and motor 100 percent for the first year and 50 percent for the next 4 years for a total warrantee of 5 years starting at issuance of substantial completion.

PART 2 PRODUCTS

2.01 PACKAGE PUMPING STATIONS

A. General

1. The pump station and valve vault shall be supplied, complete with submersible sewage pumps, motors, motor controls, variable frequency drives, electrical wiring and conduits, piping and valves, vents, liquid level sensors, backup level floats, magnetic flow meter, slide rails and lift out assembly, entrance hatches, davit base and hoist, and other necessary appurtenances. Complete piping for all pumps shall be furnished and installed as shown on the Contract Drawings.

2. Pumps and motors shall be explosion proof and designed for use in hazardous locations and carry Underwriters Laboratories Class 1, Group C & D, Division 1, listing. Pump and motor combination as well as slide rail and quick-disconnect system shall be UL listed and labeled as Portable Utilization Equipment while operating in Class 1, Division 1 locations. Flexible motor cable supplied by the manufacturer shall be UL Listed for Division 1 hazardous location duty.

B. Pump Station Wetwell and Valve Vault

1. The precast reinforced concrete pump station wetwell and valve vault shall be of the size and type shown on the Contract Drawings and shall conform to the applicable requirements of ASTM C478. Wire fabric for reinforcement shall conform to the requirements of ASTM A185 and steel reinforcement shall conform to the requirements of ASTM A615 Grade 40. The precast reinforced concrete structures shall be designed against buoyancy for a hydrostatic head equal to the depth of the structures and shall be capable of withstanding an H-20 truck load.

2. All interior surfaces (walls, floors and ceilings) of the precast reinforced concrete pump station wetwell and valve vault shall be coated with a 100 percent Solids Modified Amine Epoxy as specified under DIVISION 9 – FINISHES of these specifications:

C. Entrance Hatch

1. The access opening sizes shall be as shown on the Contract Drawings. The pump station wetwell and valve vault shall have entrance hatches mounted above the pumps and/or as shown on the Contract Drawings. The size of the entrance hatches shall be as shown on the Contract Drawings to allow removal of both pumps provided and access to all other pump station equipment. The manufacturer shall guarantee proper operation and against defects in material or workmanship for a period of five years.

2. The hatches shall be of aluminum construction as manufactured by Syracuse Casting Sales Corp., Cicero, New York, Bilco Company or equal. The hatch covers shall be double leaf or single leaf as indicated, watertight self-draining type. Each leaf shall be of 1/4-inch thick aluminum diamond pattern plate capable of withstanding an H-20 truck load. Channel frame shall be of 1/4-inch thick aluminum with anchor flange around the perimeter. Each door leaf shall be equipped with a minimum of two stainless steel hinges with stainless steel pins, spring operators to allow easy operation, and an automatic hold-open arm with release handle. Hatch shall be provided with recessed padlock clasp and padlock as manufactured by Corbin (No. 2863, 1/4W) or equal by Schlage (No. 912). A 1-inch drainage coupling shall be located in the front right corner of the channel frame. Wetwell hatch drain shall discharge directly into pump station wetwell. Valve vault hatch drain shall be piped to discharge into the sump. Hardware shall be stainless steel and factory finish shall be mill finish with bituminous coating applied to exterior of frame. Hatch padlock and keyset shall be coordinated with the Owner.

3. Provide a hinged safety grate with the entrance hatch.

   a. Grate shall have openings 5-inch by 5-inch, shall have a permanent hinging system which will lock the gate in the 90 degree position once opened, shall have an opening arm with a vinyl grip handle which will allow opening of the grate while providing the grate as a barrier between the operator and the opening, and shall be painted with a safety orange paint.

b. Safety grate shall be constructed of 6061-T6 aluminum with a minimum ultimate strength of 38,000 psi and minimum yield strength of 35,000 psi as per A.S.T.M. B221. Grate shall withstand live loads of 300 pounds per square foot with a deflection not to exceed 1/150th of the opening. Welding shall be in accordance with ANSI/AWS D1.2-90 Structural Welding Code for Aluminum. Hinged safety gate shall be as manufactured by Syracuse Casting Sales Corp., Cicero, New York, or equal. Size shall be coordinated between grate, hatch and pump manufacturer.

4. Pump manufacturer shall coordinate with hatch opening size and safety grates confirm they will not interfere with pump removal.

C. Valve Vault Access Steps

1. Valve Vault steps shall be of steel reinforced copolymer polypropylene conforming to ASTM C478, cast-in-place or installed utilizing inserts approved by the Engineer.

2. All steps shall be 12 inches on center with abrasive step surface and safety edge, drop front design, 1-inch diameter and 16 inches wide. Metal items embedded in concrete shall be painted with a zinc chromate primer.

D. Portable Davit Crane

1. Davit crane shall have a telescoping boom with hook reach/height providing lifting capacity of up to 1 ton at all boom positions and capable of safely lifting and removing station pumps.

2. Portable davit crane and base shall be galvanized steel meeting ASTM standards and shall have a corrosion resistant finish.

3. Boom angle shall be adjustable at all times, including when under full rated load. Mast and boom shall rotate 360 degrees in the base.

4. Lifting winch shall have machine cut worm gears operating in an enclosed oil bath, cast aluminum gear case and drum construction, an adjustable handle that mounts securely to the drive shaft for manual operation, bronze and radial ball bearings, pressure plate, and a positive load holding mechanical brake able to stop and hold the load automatically if the winch handle is released. Winch shall be equipped with a hex drive input to allow drill drive operation with a maximum rated drill speed of 400 rpm.

5. Wire rope shall be 7 x 19 type 304 stainless steel cable.

6. Davit crane shall break down into portable components with no single component weighing more than 100 pounds. Carrying handles shall be welded to the mast and boom. Crane base shall allow for removal of the mast

2.02 SUBMERSIBLE PUMPS AND RAIL ASSEMBLY

A. Centrifugal Pumps

1. The pumps shall be Xylem Flygt F-Pump series totally submersible chopper pump, centrifugal design with submersible type motors and semi open impellers with cutting insert ring. Pumps shall be bottom suction design, semi-permanent, and designed for wet installations.

2. Casing

   a. Casing, lifting cover and stator housing shall be constructed of grey cast iron, ASTM A48, Class 35B with smooth surfaces devoid of blow holes or other irregularities.

   b. Volute shall be single-piece grey cast iron Class 35, non-concentric design with smooth passages large enough to pass any solid that may enter the impeller. Volute shall be drilled to allow easy installation of the mix/flush valve.

   c. All exposed interior surfaces shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer that is resistant to sewage.

   d. All bolts, nuts and fasteners shall be Type 304 stainless steel.

   e. Casing shall be tested in conformance with Hydraulic Institute Standards to twice the total dynamic head, or 1.5 times the shut-off head, whichever is greater.

3. Discharge connection shall be ANSI 125 pound standard.

4. Impeller

   a. Impeller shall be of Hard Iron TM (ASTM A 532 (Alloy IIIA) 25% chrome cast iron), dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design.

   b. Impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges of the impeller shall be hardened to Rc 60 and shall be capable of handling solids, fibrous material, heavy sludge and other matter normally found in wastewater.

   c. Impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

   b. Impeller shall be capable of passing a minimum 3-inch sphere.

5. Volute/Suction Cover

   a. The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller.

   b. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groves. The insert ring shall be cast or Hard-Iron TM (ASTM A-532 (Alloy III A) 25 percent chrome cast iron) and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

6. Bearings

   a. The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angle contact bearing to compensate for axial thrust and radial forces.

   b. Minimum B-10 bearing life shall be 50,000 hours.

7. Shaft

   a. The shaft material shall be AISI Type 431 stainless steel sufficiently sized by the pump manufacturer to transmit full drive output.

   b. The pump shaft shall be an extension of the motor shaft. Couplings shall not be acceptable.

   c. The maximum shaft deflection due to axial and thrust loads shall be 0.16 mm.

8. Seal

   a. The mechanical shaft seal shall be a tandem mechanical shaft seal system consisting of two totally independent seal assemblies.

   b. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating tungsten-carbide ring.

   c. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall be one stationary tungsten carbide seal ring and one positively driven rotating tungsten carbide seal ring.

   d. The seal construction shall be such that each seal interface shall be held in contact by its own spring system.

9. Name Plates

   a. Data plates shall be provided and shall be stainless steel and mechanically attached to each pump.

   b. Data plates shall contain the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data. A special data plate shall be attached to each pump identifying the bearings.

10. Base Elbow and Pipe Connection

    a. Pumps shall have ANSI 125 pound standard flange or universal coupling bolted to pump discharge flange to accept the discharge base elbow.

    b. Base elbow shall be ASTM A48 Class No. 30 or 35 cast iron and shall be provided by the pump manufacturer.

c. Base elbow shall be connected with 316 SS anchor bolts to the bottom of the pump station wetwell as recommended by the pump manufacturer.

d. Sealing of the pump at the discharge flange shall be accomplished by a simple downward linear motion of the pump with the entire weight of the pump and motor guided to, and pressing against the discharge connection.

e. Sealing of the discharge base elbow to the pump discharge flange shall be accomplished by metal to metal contact or by a replaceable rubber seal form fitted to the machined discharge coupling to insure a positive leakproof system and ease of pump removal.

f. Shims shall not be required to insure alignment for a leak-proof seal between base elbow and pump discharge connection.

B. Pump Guide Rail Assembly and Lifting System

1. The pumps shall be arranged to allow easy removal, installation and adjustment without the necessity of personnel entering the pump station. Double circular guide rails shall be stainless steel and supplied for both pumps for easy removal without disconnection of any parts.

2. Ductile or cast iron, non-sparking guide brackets with guide yokes of sufficient bearing length to prevent binding shall bolt to the lower guide holder on the pump base elbow and the upper guide holder at the top of the pump station wetwell. The yokes shall mate over the stainless steel guide rails running between the upper rail support casting, and a lower discharge casing.

3. The circular guide rails shall be supplied by the pump manufacturer and sized as recommended by the pump manufacturer.

4. A brace, easily removable from the top of the pump station wetwell shall be provided to lock the parts together, preventing line surges from breaking the seal and allowing leakage. An upper guide plate shall be attached to each pump to support lift out fitting and guide the pump on the rails.

5. A lift handle shall be cast into each pump motor. A stainless steel lifting cable, compatible with portable hoist, shall be supplied for lifting of each pump and motor assembly. Each cable shall be connected to the lift handle with a 3/8-inch stainless steel shackle. Contractor shall supply stainless steel hardware to coil and hold excess cable. The coiled cable shall be placed into a Type 304 stainless steel hook (one for each pump) which shall be attached to the wetwell wall located so as to allow easy access from the top of the pump station.

C. Motors

1. Motors shall meet the following requirements:

a. Motors shall be supplied by the pump manufacturer and shall be constructed integral to the pump for totally submersible operation.

b. Motors shall be rated for use with variable frequency drive controller, and shall be rated Explosion proof, Class 1 Division 1, Group D; UL of FM certified.

c. Motors shall be housed in an air-filled or oil-filled watertight chamber.

d. Motors shall be of the premium efficient type.

e. Motors shall be capable of a minimum of 15 evenly spaced starts per hour.

f. The rotor bars shall be constructed of aluminum. Rotor shall be statically and dynamically balanced.

g. Dual voltage copper wound stator shall be triple dipped in epoxy enamel or tripled dipped and baked in Class F varnish to withstand a heat rise to 155 degrees C as defined in NEMA standard MG-1.

h. Motors shall include thermal switches embedded in the stator lead coils to monitor temperature of each phase winding. At 125 degrees C, the thermal switches shall open, stop the motor and activate an alarm both local and remote.

i. Motors shall also have a moisture/leakage sensor to detect water in the stator chamber. The leakage sensor shall be the float type. When activated, the sensor will stop the motor and activate an alarm both local and remote.

j. Motors shall be rated as specified hereinbefore.

k. 480 volts, 3 Ph, 60Hz, 1.15 S.F-Service Factor shall be 1.0 for inverter duty rating

D. Power and Control Cable

1. Each pump motor cable shall consist of P-122 MSHA type insulated cable with a double jacketed protection system with neoprene outside and synthetic inside, both exceeding industry standards for oil, gas, and sewage resistance. Individual conductors shall be type EPR. The cable (consisting of power and control conductors) shall run from pump motors to the control panel as shown on the Contract Drawings. This shall be a continuous cable run (no splices) for all power and control cables. The pump manufacturer shall supply the continuous cable length required for run from each pump motor to the pullbox, and from the pullbox to the variable frequency drive controller.

2. The cables shall enter the pumps through a Vellums type cable entry constructed of case allow metal and galvanized for corrosion resistance. The heavy duty cable entry shall have strain relief and shall be provided with an integral rubber grommet to protect against leakage once the cable is secured. The assembly shall allow easy changing of the cable using the same entry seal.

3. The cable leads shall be connected to terminals on an isolated terminal board. The terminal board shall be constructed of bake-o-lite and include individually O-ringed brass lugs on both upper and lower side of the terminal board. The terminal board shall be totally isolated from the motor using Buna-N O-rings fitted to the terminal board and mates with the machined terminal board housing in the motor. The system shall prevent moisture from entering the motor should leakage occur through the cable entry.

E. Corrosion Protection

1. All iron castings shall be pre-treated with phosphate and chromic rinse and coated with a high temperature baked epoxy before machining and all machined surfaces exposed to sewage shall be re-painted with a high temperature baked epoxy or iron castings shall be pre-treated with a chromic rinse and sprayed with an alkyd primer with chlorinated rubber paint finish. Contractor shall supply certificate of compliance to verify corrosion protection.

2. All hardware and fasteners shall be Type 304 stainless steel.

F. Pipe Connections

1. Premolded elastomeric sealed joints shall be used at the connections between the influent sewer pipe and precast pump station wetwell wall sections. Premolded elastomeric sealed joints shall be A-Lok, Res-Seal, Press-Wedge II, Lock Joints Flexible Manhole Sleeve, Kor-N-Seal Joint Sleeve, or equal.

1. For discharge force main, wetwell vent, and force main drain installed submerged or below grade, the annular space shall be sealed watertight with mechanically expanded interlocking synthetic rubber links of the Link-Seal type, or equal. Nuts and bolts shall be stainless steel.

2.03 EXHAUST FAN

A. The exhaust fan shall be belt driven sidewall mounted centrifugal fan.

B. Aluminum non-overloading, backward inclined centrifugal wheel

B. Open drip proof motor enclosures. Motors, permanently lubricated, heavy duty ball bearing type to match with the fan load and mounted on vibration isolators, out of the airstream

C. Fan shaft shall be ground and polished solid steel with an anti corrosive coating.

D. Permanently sealed bearings or pillow block ball bearings. Bearings shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.

E. Heavy gauge aluminum exterior housing, windband, and motor compartment housing. Galvanized material is not acceptable.

F. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.

G. Breather tube for fresh air motor cooling and designed to allow wiring to be run through it.

H. Vibration Isolation

I. Disconnect Switch- NEMA 3R

J. Drive Assembly: Belts, pulleys and keys oversized for a minimum of 150 percent of driven horsepower

K. Mounting Plate: Attached and sealed to the wall prior to installation of unit

L. Accessories: Aluminum birdscreen, gravity damper and aluminum interior mounted louvered wall grille.

2.03 ELECTRICAL CONTROL COMPONENTS

A. Pump Control System

1. The Pump control system shall be considered to include the motor controller (variable frequency drive (VFD)), level control system (MultiSmart Pump Station Manager), Multitrod Duoprobe, level float switches, flow transmitter and Mission Communications SCADA RTU.

2. Refer to specification section 16260 – VARIABLE FREQUENCY MOTOR CONTROLLERS for requirements.

B. Pump Control Panel

1. Enclosure shall be constructed in conformance with applicable section of National Electrical Manufacturers' Association (NEMA) standards, UL and all other applicable local codes for NEMA 12 electrical enclosures. Enclosure shall be fabricated of 16 or 14 gage stainless steel. All seams shall be continuously welded, and shall be free of burrs and voids. There shall be no holes through the external walls of the enclosure for mounting the enclosure or any components contained within the enclosure. Panel enclosure shall be suitable for floor mounting. Panel shall be manufactured in accordance with UL 508A, and UL 698A and National Electrical Code Article 409 and shall be UL labeled.

2. Enclosure shall be equipped with a door mounted on a continuous stainless steel hinge, and sealed around its perimeter. Door shall be held closed with a three point latching system. The door shall accommodate the mounting of switches and indicators. A lock and three (3) key sets shall be provided as approved by the Owner.

3. Enclosure shall be furnished with a removable back panel, fabricated of steel having a thickness of not less than 0.106 inch (12 gauge), which shall be secured to the enclosure with collar studs. Such panel shall be of adequate size to accommodate all basic components.

4. All control components shall be securely fastened to the removable back panel with screws and lock washers. Switches, indicators and instruments shall be mounted through the control panel door. Self-tapping screws shall not be used to mount any components. All connections from the back panel to door mounted or remote devices shall be made through terminal blocks.

5. Control panel shall be provided and adequately sized for all control devices but dimensions shall not exceed 30-inches by 30-inches by 12-inches.

6. The Pump Control Panel shall receive a 120 volt, single phase, 60 Hertz electrical supply, instruments and controls shall receive their power from this service. The incoming power supply shall have a one-pole circuit breaker to completely isolate the panel from the incoming AC service. The panel shall be protected from surges propagating along the incoming AC service by a surge protection device located within the panel and upstream of the circuit breaker.

B. A 20 ampere, 120-volt, 1-phase electrical feed will be furnished to the control panel under DIVISION 16 – ELECTRICAL. The control panel shall have a main circuit breaker and individual circuit breakers for instrumentation and control power distribution. The main input power shall be monitored and generate an Utility Failure alarm upon loss of power. Control panel shall be equipped with 120V UPS system to provide back-up power for at least 4 hours.

C. All switches, meters or instruments mounted through the door of the panel shall be watertight construction. The control panel shall conform to National Electrical Manufacturer's Association (NEMA), Joint Industry Council (JIC), and National Electrical Code (NEC) specifications, and shall be Underwriters' Laboratories (UL) listed. The panel shall be factory wired and tested.

D. Indicators

1. All indicating lights shall be "LED" type, oil-tight, press-to-test with colored lens and legend plate. Indicating lights shall be mounted through the submersible pump control panel enclosure.

2. Indicating lights shall be provided for the following functions either on the variable frequency drive enclosures or on the control panel:

a. Pump No. 1 Illuminated Green for On and Red for Off

b. Pump No. 2 Illuminated Green for On and Red for Off

c. Pump No. 1 high pump temperature

d. Pump No. 2 high pump temperature

e. Pump No. 1 seal failure

f. Pump No. 2 seal failure

g. VFD No. 1 failure

h. VFD No. 2 failure

i. High wetwell level (transducer)

j. High-High wetwell level (float)

k. Low wetwell level (transducer)

l. Low-Low wetwell level (float)

m. ATS in normal position

n. ATS Trouble (in emergency position)

o. Generator system failure.

p. Alarm silenced

E. Switch Controls

1. The manufacturer may use selector switches, pushbutton switches, a Multitrode MultiSmart Pump Station Manager pump controller with an operator interface, or any combination thereof to accomplish the switching tasks described below and to enable operators to easily adjust pump start/stop levels and level alarms at the Pump Control Panel based on the level signal from the level transducer. Switches shall be oil tight type 30 mm size with contacts rated 10 amps. The micro-processor based controller and operator interface shall be suitable for the environment.

2. Switches/microprocessor-based pump controller shall be furnished to accomplish the following minimum functions:

   a. Disconnect the control circuit.

   b. Select the mode of operation for each pump.

   c. Select the sequence of pump operation.

   d. Operate the level control system as described below.

   e. Override all controls except motor overload relays.

   f. Acknowledge one of the 115 volt AC alarm circuits and reset the high wetwell level alarms and low wetwell level alarm circuits.

3. The control circuit shall be fused, and shall be provided with a circuit breaker to allow control power to be disconnected from all control circuits.

4. Pump mode selector switches shall be connected to permit manual start and manual stop of each pump motor individually. Each switch shall be connected to one or more indicators that shall be illuminated to indicate the selected mode of operation. Manual operation shall not override shutdown systems supplied with the level control system.

5. Pump sequence selector switch shall permit selection of automatic pump alternation, or selection of either pump to run as lead pump for each cycle.

6. Override switches shall be connected to bypass the level control system and all shutdown systems supplied with it, to provide manual start and manual stop of each pump individually in the event of level control system malfunction.

7. A pushbutton switch shall be provided to acknowledge the 115 volt AC alarm circuits while corrective actions are underway. Depressing the alarm silence pushbutton shall also cause the high wetwell level or low wetwell level alarm circuit to reset when the liquid level has been lowered or raised, respectively.

F. Motor Over-Temperature - A motor over-temperature sensor circuit shall be provided for each pump to detect abnormal and detrimental motor temperature. The circuit shall de-energize the motor, and energize a pilot light indicating temperature alarm. A push-button shall be provided to reset circuit after the over-temperature condition has been corrected.

G. Moisture Sensing Circuit - A moisture sensing circuit shall be provided for each pump to detect water leakage into the cavity of the pump. A pilot light shall be energized for this condition for each pump. A push-button shall be provided to reset circuit after the over-temperature condition has been corrected.

H. Six-digit elapsed time meters (non-reset type) shall be connected to each VFD to indicate the total running time of each pump in "hours" and "tenths of hours".

I. Wiring

1. All wiring, workmanship, and schematic wiring diagrams shall be in compliance with applicable standards and specifications for industrial controls set forth by the Joint Industrial Council, National Machine Tool Builders Association, and the National Electric Code.

2. All user serviceable wiring shall be Type MTW or THW, 600 Volts: Provide 16 AWG shielded cable pairs for all analog signals internal to the panels.

J. Wire Identification and Sizing

1. Control circuit wiring inside the panel, with the exception of internal wiring of individual components, shall be 16-gauge minimum, Type MTW or THW, 600 volts. Wiring in conduit shall be 14-gauge minimum.

K. Wire Bundles

1. Control conductors connecting components mounted on the enclosure door shall be bundled and tied in accordance with good commercial practice.

2. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall be allowed so that the door can swing to its full open position without undue mechanical stress or abrasion on the conductors or insulation.

3. Bundles shall be clamped and held in place with mechanical fastening devices on each side of the hinge.

L. Grounding

1. Provide a grounding terminal strip bonded to the panel enclosure with 20 percent spare terminals.

2. Individually connect ground wires between control panel components to grounding terminal strip

M. Relays - Heavy duty relays shall be 600 volt industrial control type. Intrinsically safe relays shall be furnished for interconnection of each wet well float switch and level transducer with the control panel.

N. Surge Protection

1. Provide Surge Protection Devices (SPDs) for panel as follows:

   a. For each power feed into the control panel.

   b. Rated a minimum of 10 kilo amps (kA)

   c. With light indicating fault

   d. Mount SPD inside control panel

   e. Minimize lead length of SPD

   f. SPD manufactured by Joslyn, Dehn, MTL, Harger or equal

2. Provide surge protection for analog signals as follows:

   a. For signals originating in a structure outside the one housing the control panel or greater than 200 feet from the control panel.

   b. Surge protection shall be: two-stage common-mode protection by means of arrestor reactor and varistor in combination and differential mode protection by means of gas arrestor, reactor and zener diode in combination.

   c. Rated a minimum of 10 kilo amps (kA)

   d. Manufactured by Dehn, Harger, MTL or equal.

2.04 PUMP CONTROL PANEL INPUTS/OUTPUTS

A. The Pump Control System shall accept the following inputs from process equipment and sensors mounted external to the Pump Control Panel and generate the following outputs:

1. High Wetwell Level (discrete input - transducer).

2. High High Wetwell Level (discrete input - float).

3. Low Wetwell Level (discrete input - transducer).

4. Low-Low Wetwell Level (discrete input – float)

5. Wetwell level (analog input).

6. Discharge Flow (analog input)

7. Pump Speed signal (analog output)

8. Pump No. 1 Seal Failure (discrete input), via seal failure relay.

9. Pump No. 2 Seal Failure (discrete input), via seal failure relay.

10. Pump No. 1 Run Status (discrete input).

11. Pump No. 2 Run Status (discrete input).

12. Pump No. 1 Motor Over-Temperature (discrete input), via over-temp relay.

13. Pump No. 2 Motor Over-Temperature (discrete input), via over-temp relay.

14. Pump No. 1 Start/Stop Signal (discrete output).

15. Pump No. 2 Start/Stop Signal (discrete output).

16. Pump No. 1 HOA Switch in Auto (discrete input).

17. Pump No. 2 HOA Switch in Auto (discrete input).

18. Generator System failure.

19. Generator System run

20. ATS in Normal position.

21. ATS Trouble (in Emergency position)

22. VFD 1 failure (discrete input)

23. VFD 2 failure (discrete input)

24. Main Breaker Trip (discrete input)

25. Utility Power Failure

26. Common Fault (discrete output)

27. Common Fault (discrete output) to audible signal

2.05 NAMEPLATES

A. Nameplates shall be furnished and installed for all switches, control stations, motor starters, terminal cabinets, indicating lights, etc. to designate the equipment controlled and function.

B. Nameplates shall be black and white laminated phenolic material having engraved letters approximately 1/8 inch high, extending through the black face into the white layer. Nameplates shall be attached to panels by self-tapping screws or rivets and shall be stainless steel. A special nameplate shall be attached to the pump housing which shall contain identification of housing and bearing numbers.

2.06 PUMP CONTROLS

A. Pump Station Manager

1. Pump station manager shall be a Multitrode MultSmart controller with LCD HMI operator interface, with 20 digital inputs, three digital outputs, 2 analog inputs and 1 analog output. An additional 3MP I/O board shall be provided with 5 digital outputs and 3 analog outputs. Additional third party I/O shall be provided to accommodate I/O requirements as shown on the drawings. All input/outputs shall be programmable.

2. Provide an intrinsically safe 10 channel barrier for probe – MTISB10, and a third party barrier for the analog level signal input.

B. Pump Operation

1. Normal pump operation shall be the "lead" pump starting operation when the "Lead Pump On" level is reached in the wetwell and stopping operation when the "Pumps Off" level is reached in the wetwell. The "lead" pump shall alternate with each pump cycle. A submersible pressure transducer will sense wetwell water levels for starting and stopping and controlling the speed of each sewage pump. The "lead" and "lag" pumps will automatically alternate after each pump cycle. The pumps shall operate together in parallel if the liquid level in the wetwell rises above the "Lag Pump On" level with the lead pump operating.

2. When either pump selector switch is placed in the "Hand" mode, the pump shall immediately operate, bypassing all automatic controls. When either pump selector switch is placed in the “Off” mode, the pump shall not operate. When either pump selector switch is placed in the "Auto" position, the pump shall be started/stopped based on either the level transducer signal or the high-high and low-low level float switches.

3. Float switches shall be used as a completely separate back-up control to the level transducer. If the high-high level float switch is activated, then Pump No. 1 and Pump No. 2 shall be called to start. Both pumps shall be called to stop if level drops below the low-low level float switch.

B. Level Sensors

1. Two float type switches, each encapsulated within a solid polyurethane float ball shall be provided to serve as backup high and low water indication. Float switches shall be mounted as shown on the Drawings. Float switches shall be provided with individual weights. A mounting bracket shall be provided near the access opening to allow adjustment of the alarm level as shown on the Drawings. Float switches installed in a classified area shall be provided with intrinsically safe relays. The intrinsically safe relays shall be mounted in the VFD Panel.

2. Each float switch shall be furnished with cable lengths to suit the installation without splices for connection back to the VFD panel, refer to drawings for equipment locations.

C. Level Element (submersible pressure transducer) and Level Transmitter

1. Provide and install a Multitrode Duoprobe conductive level unit with 10 sensors and a submersible transducer with vented cable. Sensor shall be two-wire, pressure sensing technology with welded 316 stainless steel diaphragm and small bore design. Level element and transmitter shall sense pressure and produce a standard 4-20 mA DC output signal linear with wet well level.

2. Level element and transmitter shall be Multitrode Duoprobe and MultiSmart pump controller.

3. Provide a standard mounting bracket kit for the probe – MTAK-1.

D. Magnetic Flow Meters and Indicator Transmitters

1. Provide and install a magnetic flow meter and flow indicating transmitter as shown on the Drawings.

2. The magnetic flow meter shall produce a low-level voltage output signal proportional to flow rate. The magnetic flow meter shall have power supplied by a magnetic flow converter and shall have a maximum power consumption of 1 Watt per 5 mm (diameter). The magnetic flow meter shall be rated NEMA 4X plus temporary submergence at 25-ft for 48 hours for installation in a Class 1 Division 2 classified area.

3. The electrodes shall be Type 316 SS and the body shall be carbon steel with a polyurethane liner. The magnetic flow meter shall have ANSI Class 150 RF carbon steel flange end connections. The exterior surface shall be epoxy coated. The coils shall be completely potted with an epoxy-based compound. Stainless steel grounding rings with grounding strap shall be provided. The magnetic flow meter shall have FM approval.

4. The magnetic flow meter shall have an accuracy of ±0.5% of rate between 10% and 100% of flow (including transmitter). Certified hydraulic lab calibration data shall be provided.

5. The remote flow indicating transmitter shall have a liquid crystal display with rate and total. The remote transmitter shall be housed in the control panel or in a NEMA 4X enclosure. The flow indicating transmitter enclosure shall be suitable for wall mounting as shown on the Drawings. The flow indicating transmitter provides coil drive current to the magnetic flow meter and converts the electrode signal from the magnetic flow meter into 4-20 mA signal linear with flow, and shall be provided with sufficient length of cable (at least 60 feet) for connection to the magnetic flow meter. The flow indicating transmitter shall be microprocessor-based with data stored in nonvolatile EEPROM memory, perform continuous self-diagnostics and have solid-state integrated circuitry with feedback electronically controlled. External contacts shall initiate circuitry that clamps the output to 4 mA under no flow conditions.

6. The flow indicating transmitter shall operate from a 120 VAC ±10%, 60 Hz power source from the Pump Control Panel and shall output a 4-20 mA DC into 0 to 750 ohms. The flow indicating transmitter shall have an accuracy of ±0.5% of rate between 10% and 100% of flow (including flow element).

7. The magnetic flow meter and flow indicating transmitter shall be as manufactured by Krohne, Foxboro, Rosemount or approved equal. See Instrumentation Data Sheet following this specification section.

2.07 SCADA RTU SYSTEM

A. Pump station SCADA system shall be MISSION Communications model M-800 with wireless communication through cellular data. The system will match existing equipment to communicate with MISSION based computers and software. The system shall:

1. Connect continuously without polling. Analog and digital inputs changes shall be updated as they occur.

2. Call correct phone numbers to deliver alarms.

3. Detect busy and ringing signals, abandon a call if busy, and wait until a call is answered to annunciate voice reports.

B. The system shall continuously monitor the presence of AC power and the status of at least eight (8) contact closure inputs.

C. The unit shall be equipped with a real time clock making it possible to be user programmable to follow a specific schedule of operations and to time and date stamp alarms.

D. Normal power shall be 105-135 VAC, 15 watts nominal. The system shall contain a gel cell rechargeable battery that is automatically kept charged when AC power is available. The system shall operate on battery power for a minimum of 20 continuous hours in the event of AC power failure. The built-in charger shall be precision voltage controlled, not a trickle charger, to minimize recharge time and maximize available battery life.

E. All power, dry contact and analog signal inputs shall be protected at the system's circuit board to IEEE Standard 587, Category B (6,000 volts open circuit/3,000 amps closed circuit). Gas tubes followed by solid-state protectors shall be integral to the circuit board for each line.

F. The user shall be provided and/or have access to a DVD format video recording programming guide, and a toll free number for technical service.

G. The system shall be covered by a five (5) year warranty covering parts and labor performed at the Factory.

H. All keyboard and front panel switches shall be sealed to prevent contamination. Front panel LEDs shall indicate: Normal Operation; Program Mode; Call in Progress; Status (for each channel); AC Power; AC Power Failure; and, Low, Discharging or Recharging Battery. On any inquiry telephone call or on-site status check, the voice shall provide specific warning if no dial-out phone numbers are entered, or if the system is in "alarm disabled" mode, or if AC power is off or has been off since last reset.

I. The following alarms shall be provided to the Alarm System:

1. Pump 1 Failure
2. Pump 2 Failure
3. Low wetwell level
4. High wetwell level
5. Low-low wetwell level
6. High-high wetwell level
7. VFD 1 Failure (discrete input)
8. VFD 2 Failure (discrete input)
9. Generator Run
10. Generator Failure
11. ATS Trouble (in Emergency position)
12. ATS on Generator Feed
13. Utility Power Failure
14. Common Fault (discrete output)
15. Eight (8) spare discrete alarm inputs.

Q. The system shall be M-800 Series manufactured by MISSION Communications with an expansion digital input board to match existing Owner equipment.

2.08 PIPING, VALVES AND APPURTENANCES

A. Sewage Piping

1. All sewer piping and fittings shall be of the sizes indicated on the drawings and shall be grade 60-40-10 Ductile Iron. The pipe shall be centrifugally cast and manufactured in accordance with ANSI specifications A21.50 and A51.51. All ductile iron pipe shall be cement lined to twice the thickness in 10ANSI A21.51 and ANSI A21.4 and shall be asphalt seal coated twice.

2. Exterior pipe shall be Class 52 ductile iron. Pipe joints shall be mechanical or "push on" type with rubber gaskets and shall conform to ANSI A21.11. Fittings for exterior pipe shall be cast or ductile iron conforming to ANSI 21.10. Fittings shall be restrained mechanical joint conforming to ANSI A21.11 and rated for 150 psi working pressure. Fittings shall be coated and lined as specified above.

3. Interior pump station wetwell piping shall be Class 52 ductile iron conforming to ANSI A21.51. Pipe joints shall be flanged with gaskets, nuts and bolts conforming to ANSI A21.15. Flanges shall be flat face and gaskets shall be full face. Interior fittings shall be cast or ductile iron conforming to ANSI A21.10. Fittings shall have flat faced flanges, full face gaskets and be rated for 150 psi working pressure. Fittings shall be coated and lined as specified above.

B. Check Valves

1. Valves shall be iron body, bronze mounted full opening swing type. Valves shall have a bronze or steel or cast iron disc plate suspended at the top from a stainless steel shaft. Disc shall be bronze faced. Valve shaft shall be supported by bronze bushings and bearings and shall be packed through externally accessible stuffing box. Valves shall be constructed to permit top entry for complete removal of internal components without removing the valve from the line. Valve closure shall be assured by means of an outside lever and adjustable weight. Check valves shall be installed in the position as shown on the Drawings. Valves shall be rated for 175 psi working pressure and 350 psi hydrostatic pressure.

2. The valves shall be compatible with 125 pound ANSI drilled flange. Valves shall be cleaned and shop primed on the outside with a rust inhibitive priming system. All check valves shall be horizontally mounted.

C Resilient Seated Gate Valves

1. Valve body shall be cast iron conforming to the latest edition of ASTM A126, Class B. Valves shall mechanical joint, with a two (2) inch operating nut and shall conform in every respect to AWWA C509. Valves shall be designed for one hundred twenty five (125) psi working pressure and shall be hydrostatically tested with twice the specified rated pressure applied to one side of the gate and zero (0) pressure on the other side.

2. When mechanical joint ends are specified for use, the gasket seating areas shall be fully machined to fixed dimensions and tolerances as per AWWA specifications. All valves shall be provided with "O" rings. The design of the valve shall be such that the seal plate can be fitted with new "O" rings while the valve is under pressure in a fully open position.

3. Exterior surfaces of all valves shall be coated with a minimum of three applications of an approved bituminous solution, on a rust-free casting, prior to shipment. Valve interiors shall have a one hundred (100) percent solids thermoset or fusion bonded epoxy protective coatings, holiday-free in the waterway, which shall meet all requirements of AWWA C550. The coating shall be applied and cured in strict conformance with the coating manufacturer's instructions. The coatings shall be applied by the valve manufacturer under controlled factory conditions and field application is strictly prohibited.

4. Valves shall open right and shall be as manufactured by US Pipe Metroseal, Mueller Model A2360 or M&H Style 3067.

5. Provide one (1) tee wrench.

D. Plug Valves

1. Valves shall be of the non-lubricated type with resilient faced plugs, and provided with flanged ends. Nominal port areas shall be a minimum of 80 percent. Bodies shall be semi-steel. Seats shall have a welded in overlay of 90 percent pure nickel. Valves shall have a stainless steel permanently lubricated upper and lower plug stem bushing. Valves shall be designed so that they can be repacked without removing bonnet from the valve.

2. All exposed nuts, bolts, springs, and washers shall be zinc plated, except, that valves for submerged service shall have stainless steel hardware. Flanged valves shall conform to ANSI 125 pound standard. Flanges of valves through 12 inches shall have face to face dimension of standard gate valves.

3. Provide one (1) cast iron handwheel.

E. Valve Extension Stems

1. Valve extension stems shall be furnished for each exterior gate valve. Stems shall have a two inch operating nut and a two inch coupling for connection to the valves. Shaft lengths shall suit the particular installation. All operating nuts shall be located 18 inches below finished grade.

F. Valve Boxes

1. Valve boxes shall be provided for all buried valves. Valve boxes shall be cast iron, tar coated, sliding type and adjustable together with a cast iron cover.

2. For buried installations, bell end shall be sufficiently large to fit over the stuffing box of the gate valve.

3. All buried valves shall be tagged with aluminum or bronze discs with a stem embedded in a concrete pad surrounding the valve box.

4. Covers shall have the word “SEWER” cast-in the top according to the type of service.

G. Wetwell Vent

1. Wetwell vent and valve vault air intake shall be ductile iron grade 60-40-10, Class 52. The vent shall be "push on" or mechanical joint below grade and flanged above grade.

2. The top of the wetwell vent shall be furnished with a carbon filter odor control system. The unit shall be furnished with all necessary bushings and adaptors. The unit shall be self-contained Model CF6 Carbon Filters as manufactured by OSI or approved equal. Provide four (4) carbon refill kits.

H. Pressure Gauges

1. Pressure gauges shall be furnished in the location shown on the Drawings.

2. Threaded taps shall be provided on all process lines to receive gauges. Gauge connections shall consist of a 1/2-inch stainless steel nipple and a stainless steel, 1/4-turn ball valve located between the process line and the snubber. Snubber shall be cartridge type with housing with the necessary adapters for the connections required to the gauge. A 1/2-inch stainless steel flushing connection with stainless steel ball valve shall be provided ahead of the diaphragm assembly along with the necessary adapters for a 3/4-inch hose connection.

3. Pressure gauges shall be compound type with a pressure rating as indicated on the drawings or as directed on the shop drawing submittal. Gauge accuracy shall be ± 1% of full span.

4. Gauges shall be liquid filled, temperature compensated, stem mounted, Bourdon tube type gauges with a 4-1/2 inch dial face (white face with black pointer). The gauges shall be silicone oil filled. Gauge construction shall be AISI type 316 stainless steel tube and socket with stainless steel case and polycarbonate window. Gauges shall be Ashcroft Type 1009, or equal.

5. Diaphragm type gauge isolators shall be installed on all gauges and shall be Ashcroft type 100 capsule diaphragm seals with AISI type 304 stainless steel top and bottom housings and diaphragms.

6. Threaded taps shall be provided on all process lines to receive gauges. Gauge connections shall consist of a 1/2-inch stainless steel nipple and a stainless steel, 1/4-turn ball valve located between the process line and the snubber. Snubber shall be cartridge type with housing with the necessary adapters for the connections required to the gauge. A 1/2-inch stainless steel flushing connection with stainless steel ball valve shall be provided ahead of the diaphragm assembly along with the necessary adapters for a 3/4-inch hose connection.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the work of this Section, verify that the project is ready for this work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer’s instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations at no additional cost to the owner.

D. Notify subcontractors involved or affected by this work and coordinate the work with them.

3.02 GENERAL REQUIREMENTS

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. All wiring of the equipment shall be as specified under DIVISION 16 - ELECTRICAL of these specifications.

C. Installation of pumping station and all equipment shall be in accordance with written instructions provided by the manufacturer and as approved by the Engineer.

3.03 PAINTING

A. Shop painting and the surface preparation is a part of the work of this section and shall be as specified under DIVISION 9 – FINISHES of these specifications.

3.04 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from each pump station, piping and pumps. Spillage of lubricants used in servicing the system shall be cleaned from all equipment and concrete surfaces.

3.05 MANUFACTURER'S FIELD SERVICES

A. A minimum of two (2) days shall be provided for installation of the pump station.

B. A minimum of two (2) days shall be provided for startup of the pump station.

3.06 MANUFACTURER'S TRAINING

A. A minimum of one day shall be provided for manufacturer's training of the pump station.

B. Training shall be performed at the project site.

3.07 LUBRICATION REQUIREMENTS

A. All lubricating oils required for the first year of operation shall be provided for the pump station.

3.08 SPARE PARTS

A. One set of the following spare parts shall be provided for the pump station:

1. One set of Lower Bearings
2. One set of Upper Bearings
3. One set of Mechanical Seals
4. One O-Ring Kit
5. Two sets of Wear Rings or Insert Rings
6. One box of Pilot Lights for Each size and Type Used
7. One box of Fuses of Each Size and Type Used
8. Four (4) carbon refill kits for carbon filter odor control system

B. Pack spare parts in suitable containers or boxes bearing labels clearly designating contents and piece of equipment for which they are intended.

3.09 FACTORY TESTS

A. Provide motor shop testing in accordance with Section 16220 and as specified.

1. Conduct motor efficiency and power factor tests at full load 100 and 50, 75 percent load.

2. Provide the following motor tests in accordance with ANSI/HI 11.6

a. Test motor integrity in a submerged condition.

b. Dry run no load test.

c. Motor electrical integrity test.

d. Moisture and temperature sensors integrity test.

B. Pump Tests:

1. Test pump casings under a hydrostatic head of at least 75 psi or 150 percent of rated shutoff head, whichever is greater. Test casing with pump assembled.

2. Provide certified performance tests as specified herein for all pumps.

3. Certified performance testing.

a. Testing of submersible pumps dry is not acceptable.

b. Run pump at full speed rating point for 60 minutes prior to start of any testing.

c. Full speed tests:

(1) Test pumps at the conditions specified and indicated and take not less than seven operating points between shut-off and run out. Test points must be at the conditions specified and indicated.

(2) Take readings to determine flow, differential pressure, rpm, horsepower, and wire to water efficiency.

(3) Operate each pump for not less than one hour and take readings to determine that the pump will operate as specified and indicated without cavitation at the specified minimum head condition with not more than the specified NPSH available.

d. Conduct additional tests as follows:

(1) Run each pump at the minimum speed rating point for 4 hours and continuously record motor temperature. Pumps must be run submerged at LWL submergence as indicated.

e. Factory tests on pumps:

(1) Use factory calibrated test drives.

f. Provide a minimum of 30 days written notice to the Engineer prior to shop testing.

4. Run all tests in accordance with the latest standards of the Hydraulic Institute and as specified.

5. Testing Acceptance Grade and Tolerances:

   a. ANSI/HI 14.6 Acceptance Grade: 1U.

   b. Efficiency Tolerance: -0 percent.

   c. If pumps do not meet the tolerances specified, trim the impeller and retest until the specified results are obtained.

6. In the event that specified tests indicate that pump, motor, or variable frequency drive will not meet specifications, Engineer has the right to require additional complete witnessed tests for all pumps, and motors, at no additional cost to the Owner.

7. Repeat tests until specified results are obtained.

8. Correct or replace promptly all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

3.10 FIELD TESTING

A. Test piping connections to prove the pump nozzle are installed with the pipe in a free supported state and without need to apply vertical or horizontal pressure to align piping with pump nozzles. This must be performed and the piping acceptable prior to any field performance testing.

B. Field testing will not be conducted without an accepted procedure, calibration certificates for all testing equipment, gauges and flow meters and a completed and signed pretesting check list. See Division 1 for checklist.

C. After installation of pumping equipment, and after inspection, operation, testing and adjustment have been completed by the manufacturer’s field service technician, conduct running test for each pump in presence of the Engineer to determine its ability to operate within the vibration and temperature limits specified, and to deliver its rated capacity under specified conditions.

   1. During tests, observe and record head, capacity, and motor inputs.

      a. Test Duration: Determined by the Engineer, but not less than three hours of continuous operation at each condition specified and indicated.

   2. Immediately correct or replace all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

   3. Repeat tests until specified results are obtained.

   4. Contractor to provide all water labor, piping, testing equipment, equipment, flow meters and test gauges for conducting tests.

      a. Contractor shall provide calibrated test gauges for all permanently installed gauges and portable calibrated flow meters for all pumping systems even in those cases where permanent flow meters are installed.

b. All calibrations must be within 30 days of the field testing.

c. The testing will not be started and will not be accepted until the calibrated testing equipment stated above is operational and all certifications have been submitted.

D. Make all adjustments necessary to place equipment in specified working order at time of above tests.

E. Test pump on product only. If product is not available, test with water. Water for testing furnished by Contractor.

F. Remove and replace equipment at no additional cost to the Owner with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Engineer that equipment will perform the service specified, indicated and as submitted and accepted.

END OF TEXT

SEE ATTACHED TABLES

UNINTERRUPTIBLE POWER SUPPLY (UPS) SPECIFICATION

DATA SHEET NO. 7021

GENERAL

1.	Tag No.:	UPS-1
2.	Service:	BACKUP FOR PUMP STATION CONTROL, PANEL CP-1
3.	Location:	IN CONTROL PANEL ENCLOSURE

UPS

5.	Input Voltage:	120 VAC @ 60 HZ +/- 20%
6.	Output Voltage:	120 VAC @ 60 HZ +/- 3% SINE WAVE, LESS THAN 5% THD
8.	Operating Temp.:	32 TO 100 DEG. F.
9.	Surge Protection:	6000 VOLT AND MEET IEEE C62.41 CATEGORIES A AND B
10.	Backup Time:	4 HOURS MINIMUM AT 125% OF FULL LOAD
11.	Low Battery Ind.:	REQUIRED
12.	Brownout Protection:	REQUIRED AT 95 VAC
13.	Efficiency:	90% MINIMUM ON-LINE
14.	Transfer Time:	LESS THAN 1 MILLISECOND
15.	Digital Disp. Param.	VOLTAGE IN, VOLTAGE OUT, BATTERY VOLTAGE, PERCENT LOADING, ALARMS
16.	Alarms:	LOW BACKUP TIME, OVERLOAD, REPLACE BATTERY, LOW BATTERY
17.	Audible Noise:	LESS THAN 50 dB @ 3 FT

BATTERY

18.	Type:	SEALED, MAINTENANCE-FREE,LEAD-ACID
19.	Battery Protection:	THERMAL, OVERVOLTAGE AND OVERCURRENT

MISCELLANEOUS

21.	Manufacturer(s):	EATON, BEST, SOLA, or APC
22.	Model No(s).:	EATON POWERWARE 5P SERIES OR EQUAL

NOTES.

a. Provide UPS system such that upon failure of the UPS feeder, batteries provided with UPS immediately take over as the power source.

b. Provide UPS sizing calculations in the shop drawing submittal. Provide sizing calculations which are based on required load plus 25%.

MAGNETIC FLOW METER SPECIFICATION

DATA SHEET NO. 416. 11

GENERAL

1.	Tag No.:	FE- 105 / FIT-105
2.	Service:	Raw Wastewater
3.	P & I D No.:	01 DI-601
4.	Location:	Valve Vault

CONNECTIONS

5.	Line Size:	8 inch
6.	Line Material:	DUCTILE IRON
7.	Conn. Type:	FLANGED
8.	Conn. Materials:	CARBON STEEL

PROCESS CONDITIONS

9.	Fluid:	Raw Sewage
10.	Maximum Flow:	1300 GPM
11.	Max. Flow Velocity:	14.75 FPS
12.	Minimum Flow:	800 GPM
13.	Min. Flow Velocity:	9.08 FPS
14.	Operating Temp.:	40 TO 75 DEG. F.
15.	Operating Pressure:	40 psi

METER

16.	Meter Size:	6 inch
17.	Tube Material:	304 STAINLESS
18.	Housing:	WELDED STEEL
19.	Liner Material:	INJECTION MOLDED HARD RUBBER OR EQUIVALENT
20.	Electrode Type:	FLUSH MOUNT
21.	Electrode Material:	316 STAINLESS OR EQUIVALENT
22.	Terminal Box:	DIE CAST ALUMINUM
23.	Enclosure Class:	NEMA 4X – CLASS 1 DIVISION 2, IP67
24.	Power Supply:	120 VAC, 60 HZ
25.	Grounding Type:	STRAP AND RING

TRANSMITTER

26.	Type:	INTELLIGENT, MICROPROCESSOR BASED
27.	Mounting:	CONTROL PANEL
28.	Transmitter Range:	0 - 100
29.	Enclosure Class:	NEMA 4X
30.	Power Supply:	120 VAC, 60 HZ
31.	Analog Output:	4 - 20 mADC
32.	Elect. Class:	SEE ELECTRICAL DESIGN FOR AREA CLASSIFICATION
33.	System Accuracy:	+/- 0.5% OF FLOW RATE AT VELOCITIES ABOVE 3 FPS
34.	Sys. Repeatability:	+/- 0.1% OF FULL SCALE
35.	Empty Pipe Detect.:	REQUIRED
36.	Local Display:	MULTI-LINE LC FOR MEASURED VARIABLE, DIAGNOSTICS PLUS BAR GRAPH AND KEY PAD
37.	Local Totalizer:	REQUIRED, 6 DIGIT, NON RESET
38.	Cable Length:	APPROX. 50 FEET PROVIDED BY METER MANUFACTURER
39.	Input Impedance:	10**12 OHMS OR GREATER

MISCELLANEOUS

40.	Manufacturer(s):	FOXBORO, E+H, KROHNE OR SIEMENS
41.	Model No.:	8000 SERIES, PROMAG W, ENVIROMAG OR MAG 5100

NOTES

a. Provide grounding ring from meter manufacturer. Fabricated grounding rings from a third party shall not be accepted.

b. Provide meter manufacturers cable between the meter and the transmitter.

c. Wet calibrate all meters (at 3 points over the specified flow range) by gravimetric or volumetric methods that are traceable to NIST (National Institute Standard Testing).

d. Provide certificate of wet calibration to the engineer/owner prior to meter installation.

e. Provide, by the meter manufacturer, insitu calibration of all meters prior to system acceptance. Submit written calibration report from the manufacturer to the engineer.

f. Provide 316 stainless steel mounting hardware including all nuts and bolts connecting the meter to the process pipe.

g. Contractor to provide all power and signal cable in rigid conduit or liquid-tight conduit. See electrical specification for product specifications.

h. Contractor to provide grounding from ground rings to meter and meter to ground, using green size 10 AWG (6mm) ground wire. The Contractor shall install ground as directed by the meter manufacturer or to nearest water pipe. Contractor is responsible for all connections.

i. Remote communication must not interfere with the analog output signal. Use frequency shift keying (FSK) technique for communication.

LEVEL SWITCH (FLOAT TYPE) SPECIFICATION

DATA SHEET NO. 853. 1

GENERAL

1. Tag Number: SEE TABLE BELOW
2. Service: SEE TABLE BELOW
3. P & I D No.: SEE TABLE BELOW
4. Location: SEE ELECTRICAL DRAWINGS

TAG NO.	SERVICE	ON LEVEL	P&ID	SETPOINT
LSLL-103	WET WELL	INCREASING	30 DI-001	SEE MECHANICAL DRAWINGS
LSHH-103	WET WELL	DECREASING	30 DI-001	SEE MECHANICAL DRAWINGS

FLOAT

5. Dimensions: APPROX. 6 INCH DIAMETER
6. Material: POLYPROPYLENE

SWITCH

7. Type: MICRO SWITCH STEEL BALL ACTIVATED
8. Contact: SPDT
9. Rating: 5 AMPS AT 120 VAC
10. Enclosure: ENCAPSULATED
11. Open/Close: CLOSE
12. On Level Incr/Decr: SEE TABLE BELOW
13. Output Signal for: WET WELL LEVEL
14. Mounting: ADJUSTABLE CLAMP ON 1 INCH STAINLESS PIPE
15. Elec. Classification: SUITABLE FOR WASTEWATER APPLICATIONS

PROCESS CONDITIONS

16. Operating Temperature: 40 TO 75 DEG. F.

MISCELLANEOUS

17. Interconn. Cable: REQUIRED APPROX. 150 FEET
18. Manufacturer(s): CONERY, COX OR KARI.
19. Model No(s): B8 SERIES, OPTI-FLOAT OR KA SERIES.

NOTES

a. Provide 1-inch diameter SCH 40 316L SS pipe to mount the float switch(s).

b. Provide CONERY, COX or KARI level switches as specified. Other manufacturers shall not be accepted based on performance.

c. Provide detailed instructions for proper installation of switches, enclosures and mounting hardware.

d. Provide 316 SS brackets and hardware to attach pipe to side of well or tank.

e. Provide a minimum of 3 brackets spaced a maximum of 10'-0" OC.

f. Provide all 316 SS mounting hardware to mount float switch(s) to 1-inch pipe. Mounting hardware shall allow for float level adjustment with hand tools.

g. Provide single sealed well/tank penetration for float switch(s) cables.

h. Unclassified float switch wired through intrinsically safe barrier (ISB) located within the Control Panel CP-1. ISB to be provided under Division 13.

SECTION 11396

GAS-ENGINE DRIVEN GENERATOR SET

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with providing a standby natural gas driven generator set, and other related items, as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. The unit shall be provided for indoor installation.

D. The unit shall have a standby power rating not less than what is shown on the contract drawing, at 80 percent lagging power factor, three phase, 60 Hertz, 480/277 volt, four-wire, alternating current generator.

E. The unit shall be arranged for automatic starting and stopping, and load transfer upon failure of the normal source of power through automatic throw over system. The engine generator set shall exhibit less than 20 percent voltage dip and less than 5 percent frequency dip during starting of the loads identified in Attachment A to this Section.

F. The engine-generator package shall be complete in all respects and shall include all equipment and controls necessary for a fully operational standby power supply system.

G. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

1. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance.

2. Failure to include a copy of the marked-up specification sections will result in return of the entire submittal without further review and consideration until the marked-up specification are resubmitted with the entire package.

B. Submittals required under this section include, but are not limited to the following:

1. Outline equipment and enclosure drawings, equipment catalog cuts, wiring and connection diagrams and other documents required to completely describe the systems and equipment being furnished. Elevation drawings with shipping splits and estimated weights identified.

2. Identification, description and dimensions.

3. Engine-generator drawings including vibration isolators. Drawings shall indicate size and location of anchor bolts, and conduit electrical device locations.

4. Performance specifications of all items of equipment.

5. Control panel layout drawings, dimensions, and component bill of materials. Outline drawings showing conduit entry areas and anchoring information. Description of control including operation of interface equipment.

6. Complete electrical, instrumentation, control and wiring diagrams in sufficient detail to allow installation of instrumentation and controls and electrical components.

7. Provide certificate of conformance to UL Standard 2200, Stationary Engine Generator Assemblies.

8. Attenuation curve for the silencing equipment as offered to accomplish the required silencing for this installation.

9. Information on the proposed jacket water treatment and procedures for flushing of the cooling systems.

10. Operations and Maintenance Manuals, covering all equipment furnished, annotated to reference only the specific model numbers supplied. Include parts lists and parts prices current to the date of submittal; include information relevant to part supply and ordering. Submit prior to the startup and testing of the engine/generator units.

11. Manufacturer's certified shop test record of complete engine driven generator unit.

12. Record drawings and material summary shall be shipped with the equipment.

13. Engine generator loading calculation, per the requirements of Attachment A to this section.

14. Submit generator loading calculations and data for engine, generator, and accessories, Data to be provided by engine generator system supplier:

    a. Engine Data

        (1) Manufacturer.

        (2) Model.

        (3) Number and arrangement of cylinders:

        (4) RPM.

        (5) Bore X stroke.

        (6) Maximum power at rated RPM.

        (7) BMEP at rated kW (including any parasitic loads and generator efficiency).

        (8) Piston speed, feet per minute.

        (9) Make and model of governor.

        (10) Make and model of overspeed shutdown device.

b. Generator Data

(1) Manufacturer.

(2) Model.

(3) Rated kVA.

(4) Rated kW.

(5) Voltage.

(6) Temperature rise above 40 degrees C ambient. Stator by thermometer and field by resistance in degrees C.

(7) Class of insulation.

(8) Generator efficiency including excitation losses at 80 percent PF:

(a) Full load.

(b) Three quarters load.

(c) Half load.

(9) Generator subtransient reactance in ohms.

c. Generator unit and accessories.

d. Weight of complete unit.

e. Combustion air volume in CFM.

f. Cold cranking amperes rating of engine starting batteries (CCA).

15. Provide manufacturer's printed installation instructions including anchoring details to meet earthquake requirements as specified and indicated.

16. Performance Test Reports: Upon completion of installed system, submit in booklet form all field tests performed to prove compliance with specified performance criteria including final settings of devices.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 REFERENCES

A. Electrical Generating Systems Association (EGSA):

1. 101P: Engine Driven Generator Sets.

B. Institute of Electrical and Electronics Engineers (IEEE):

1. 1: General Principles for Temperature Limits in the Rating of Electric Equipment and for the Evaluation of Electrical Insulation.

2. 120: Master Test Guide for Electrical Measurements in Power Circuits.

C. International Organization to Standardization (ISO):

1. 8528: Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets.

D. National Electrical Manufacturers Association (NEMA):

1. AB 1: Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures.

2. ICS 2: Standard for Industrial Control and Systems: Controllers, Contractors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in Industrial Control Equipment.

3. ICS 6: Standard for Industrial Controls and System Enclosures.

4. MG 1: Standard for Motors and Generators.

5. PB 1: Standard for Panelboards.

6. SG 6: Standard for Power Switching Equipment.

E. National Fire Protection Association (NFPA):

1. 30: Flammable and Combustible Liquids Code.

2. 37: Installation and Use of Stationary Combustion Engines and Gas Turbines.

3. 70: National Electrical Code (NEC).

4. 110: Standard for Emergency and Standby Power Systems.

F. Society of Automotive Engineers International (SAE):

1. ARP892: DC Starter-Generator, Engine.

2. J537: Storage Batteries

G. Underwriters Laboratories (UL):

1. 489: Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.

2. 508A: Industrial Control Panels.

3. 1236: Standard for Safety Battery Charges for Charging Engine-Starter Batteries.

4. 1446: Systems of Insulations Materials.

5. 2200: Stationary Engine Generator Assemblies.

1.07 SEISMIC DESIGN REQUIREMENTS

A. Conform to the requirements indicated on the structural drawings and as specified in herein.

B. It shall be the responsibility of manufacturer and supplier along with the Contractor to conform to the seismic design requirements for this project and for the work of this specification section.

1.08 WARRANTY AND SERVICE

A. Guarantee all components, parts, and assemblies supplied by manufacturer against defects in materials and workmanship for a period of 24 months following substantial completion.

1.09 REGULATORY REQUIREMENTS

A. All applicable Federal Laws and Regulations.

B. State of Massachusetts applicable Local Codes and Standards.

C. Furnish all documents and other information which the Massachusetts Department of the Environment requests to determine compliance with applicable Air Quality Control Laws and Regulations.

D. Stack Heights: Exhaust stacks shall be configured to discharge the combustion gases vertically and shall not be equipped with any part of device that restricts the vertical exhaust flow of the emitted combustion gases, including but not limited to rain protection device such as “shanty caps” and “egg beaters” [310 CMR 7.26(42)(d)4a].

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cummins Power Generation Inc., Onan Products

B. Caterpillar Inc.

C. Kohler Co.

2.02 GENERAL

A. Engine-generator set shall be a factory-assembled unit that is a standard production unit with existing torsional analysis data. Mixing and matching engine and generator by a third party supplier is not acceptable. The engine and generator shall be directly connected with a flexible coupling, shall be free from injurious torsional or other vibration.

B. The engine and generator shall be directly connected.

C. The engine-generator set shall allow easy access to the various parts for maintenance purposes.

D. The engine-generator set shall be pre-piped and pre-wired.

E. The complete engine-generator unit shall be free from harmful torsional or other vibration throughout the entire operating range of speed and load. The engine manufacturer shall provide, an analysis of the complete engine-generator unit, which shall show where any critical speed will be encountered, together with the order, the frequency and magnitude of any critical speed.

F. The engine-generator set operating in an ambient temperature of 104 degrees F (40 degrees C) shall have a standby power capacity of not less than that indicated at 0.80 power factor, and shall operate at a speed not to exceed 1,800 rpm.

G. Frequency regulation shall not exceed 3 Hertz from no load to rated load. Frequency variation shall not exceed plus or minus 0.3 Hertz for constant loads from no load to rated load.

H. Voltage regulation from no load to rated load shall be within plus or minus 4 percent of rated voltage for units up to and including 25 kW and within plus or minus 5 percent of rated voltage for units rated 30 kW or higher. Voltage variation shall be within +/- 1 percent of the mean value for constant loads from no load to rated load.

I. Block Load Acceptance:

1. Transient response shall conform to ISO 8528 requirements.

J. The engine generator set shall be mounted on a heavy steel sub-base with spring type vibration isolators.

K. The engine generator shall include an exhaust system and associated pipe arrangement.

2.03 GENERATOR

A. Generator shall be rated for continuous duty; shall be rotating field, engine-driven, direct-connected, synchronous type with amortisseur winding. Generator frame shall be dripproof with all openings guarded. Bearings shall be sleeve or sealed ball type. The generator shall be mechanically and torsionally matched to the engine driver and shall be provided to withstand inherent pulsating torques of the engine. Full load efficiency of the combined generator, exciter and regulator shall be not less than 95 percent. The generator windings, insulation and excitation system shall be braced to withstand any possible short-circuit stresses.

B. Generator insulation shall be Class B or F in accordance with NEMA Standard MG1-1.65. Temperature rise shall be in accordance with NEMA Standard MG1-22.40 for continuous duty at all output ratings.

C. Voltage regulator shall be an automatic, temperature compensated, solid-state type with a manual adjustment range of +/- 5 percent of rated voltage. The generator windings, insulation and excitation system shall be braced to withstand any possible short-circuit stresses.

D. Exciter shall be a solid-state, static type or brushless rotating type utilizing rotating diode rectifiers. Minimum rating of exciter shall be as indicated in NEMA Std. MG-1-22.16.

E. Components for field flashing and field discharge shall be included, if required. Fast acting fuses or other protective devices shall be incorporated where failure of regulator or exciter components could result in damage to the generator field or exciter windings.

F. Voltage regulator and static exciter shall be mounted in generator control panel or elsewhere so as to protect from and isolate from vibration.

G. The generator shall conform to the applicable parts of the following standards, unless otherwise specified:

1. NEMA MG1, Motors and Generators.

2. IEEE 43, Recommended Practice for Insulation Testing of Large AC Rotating Machinery.

3. CSA C22.2 No. 100 Designation ABL3.

4. Testing shall be in accordance with IEEE 115 and NEMA MG-1 standards

H. The stator frame shall be fabricated bar and plate steel construction.

1. All insulation materials used in the stator shall have a temperature rating of Class H per IEEE Standard 1. The coils shall be of a formed coil construction using a magnet wire meeting NEMA MW36-C specifications.

2. The complete stator shall be wound with a 2/3 stator winding pitch and processed in a vacuum pressure impregnation chamber. Encapsulation of the stator shall be accomplished with a two-part epoxy system.

I. Generator lead terminal box shall be of ample size to accept and terminate connecting cables as indicated on the drawings. Generator leads shall be furnished with terminal connectors suitable for the customers connecting cables.

J. Provide generator stator winding heater with thermostat wired at 120 volts AC to prevent formation of condensation.

2.04 GAS ENGINE

A. Heavy-duty spark ignition type, arranged for direct connection to an alternating current generator. It shall be a current model of a type in regular production by a manufacturer regularly engaged in building this type of gas engine. Engine shall have at least a published intermittent brake horsepower rating at specified generator speed required by the generator at rated full load output and shall operate without undue heating, vibration, or wear.

B. Engine shall be four cycle and naturally aspirated.

C. Ignition shall be high tension magneto with impulse coupling, low tension magneto and individual coils, or distributor and coil, and spark plugs.

D. Engine shall operate satisfactorily on natural gas of 905 Btu per cubic foot (34 MJ/m3) calorific value (low heating value.)

E. Only minor changes to carburetion system shall be necessary to convert to use of propane sold as L.P. Gas.

2.05 ENGINE ELECTRICAL SYSTEM

A. Electrical system shall include a battery, starting motor, voltage and current-regulated charging generator or alternator, and a separate battery charger. Battery shall be of suitable capacity to start engine at conditions specified and shall be guaranteed for three years.

B. Battery charger shall be automatic, two rate type providing for equalizing charge and continuous taper charging. Output characteristics shall match requirements of battery furnished. Provide charger suitable for operation on 120 volt, single-phase, 60 Hertz current to be rated not less than 10 amp direct current. Furnish battery charger with following features:

1. Direct Current Voltage Regulation: +/- 2 percent for variations in line voltage of +/- 10 percent.

2. Direct current voltmeter and direct current ammeter, each with suitable scales.

3. Automatic surge suppressor.

4. Automatic current limiting to prevent overloading due to engine cranking, shorted output or reversed battery connections.

5. Alternating current line fusing.

6. Equalize charge rate with manually set timer.

7. Integral protection to prevent battery discharge through charger on loss of alternating current line voltage.

8. Terminal block with terminals for all external connections.

C. Where wall mounting is indicated, enclosures shall be suitable for conduit connection and ventilating openings shall be guarded.

D. Provide battery rack to accommodate starting batteries and supporting rack for battery charger. Racks shall be free-standing type and installed adjacent to skid.

E. Provide 120 volts AC battery pad heater with thermostat.

2.06 ENGINE APPURTENANCES

A. Furnish engine with following appurtenances:

1. Combustion air cleaner of oil bath type or dry replaceable filter type. A tube shall connect crankcase breather with air cleaner to prevent accumulation of objectionable smoke and fumes.

2. Critical grade exhaust silencers complete with drains and flexible stainless-steel connection. The entire exhaust system shall be insulated.

B. Governor

1. For sets above 30 kW, provide electronic speed control type governor to control transient response. It shall be capable of maintaining engine speed from no load to full load within 3 percent of synchronous speed.

2.07 CONTROL PANELS

A. Engine and generator control panels may be separate panels, or a combined panel, and mounted with vibration isolators on the unit. Instruments shall be of direct-reading type, factory mounted and factory connected. Instruments shall be accurate within 3 percent.

B. Provide engine control panel with following features and instruments:

1. Three-position engine control switch:

a. Stop/Reset: In this position, the engine shall not be capable of starting and/or running. If the engine was shutdown due to the operation of a protective device, the shutdown malfunction shall be reset when the switch is moved to this position. If the engine is running when the switch is moved to this position, it shall be immediately shutdown. Provide audible alarm when switch is in this position.

b. Automatic: In this position, the engine control shall be in readiness for fully automatic operation upon receipt of a start signal.

c. Test: When placed in this position, the engine shall start and run as if a start signal were received except it shall not be connected to the bus unless a start signal is received. When returned to the automatic position, the engine will shut down.

d. Manual starting switch.

e. Full automatic starting from pilot device initiating start when normal power fails. Automatic cranking shall be interrupted cycle type not affected by ambient temperature with overall time limit. A total of five cranking cycles shall automatically shut down engine after a time delay.

2. Automatic shutdown devices with manual reset and individual indicating lights for:

   a. Low oil pressure.

   b. High water temperature.

   c. Engine overspeed.

   d. Failure of engine to start.

3. Auxiliary contacts on all aforementioned shutdown devices to operate a remote alarm. In addition, provide the following alarm contacts.

   a. Low battery voltage.

   b. Common fault alarm – provide two isolated contacts.

   c. Not in automatic.

   d. Generator run status provide minimum of three isolated contacts.

   e. Low coolant level.

4. Water temperature gauge.

5. Ammeter-charging circuit.

6. Tachometer.

7. Lubricating oil pressure gauge.

8. Fuel pressure gauge.

9. Running time meter.

10. Contacts and relays to operate exhaust fans and dampers specified under Heating and Ventilating.

11. Generator panel shall include following instruments:

    a. Voltmeter, alternating current and phase selector switch with OFF position.

    b. Ammeter, alternating current, and phase selector switch with OFF position.

    c. Voltage-adjusting rheostat.

    d. Three-phase wattmeter.

e. Frequency meter.

f. Generator load-break, molded-case magnetic circuit breaker properly sized to protect generator against short-circuit conditions. Molded case circuit breaker shall conform to the provisions of NEMA Standard AB-1 and UL Standard 489.

2.08 GASEOUS FUEL SYSTEM

A. The gaseous fuel system shall consist of gas pressure regulators and carburetors. The carburetor shall be a diaphragm type which includes a load screw for air fuel ration adjustment, and throttle body to control the air-fuel mixture to the engine.

B. Fuel system shall be fed under a pressure of 11 to 18 inch (280 to 460 mm) water column to engine regulator.

C. Carburetors shall operate at 4 to 6 oz. per square inch (1.7 to 2.6 kPa) pressure.

D. Fuel system shall include an electrically operated shutoff valve, in the supply line energized from battery circuit, that closes when engine shuts down.

2.09 ENGINE COOLING SYSTEM (RADIATOR COOLED)

A. Provide a unit-mounted radiator with integral jacket water circulating pump, and thermostatic control for cooling system.

B. Provide radiator of sufficient capacity to operate engine at full rated generator load at 120 degrees F (49 degrees C) ambient temperature.

C. Provide radiator with flange for connection to exhaust duct specified under Heating and Ventilating.

D. Provide engine coolant heater rated 120 volts, single phase, with thermostat.

2.10 ENGINE LUBRICATION

A. Provide full pressure system, supplying oil to all surfaces requiring lubrication. Circulation shall be by positive displacement pump. Full flow-type filters or filters with bypass feature shall be included. Filter elements shall be replaceable without disconnecting oil piping. Provide an oil cooler, if recommended by engine manufacturer, to properly lubricate engine at full rated generator load. Provide full charge of new oil after tests have been completed.

2.11 EXHAUST STACK AND SILENCERS

A. The engine generator unit shall be provided with a stainless steel critical type silencer including flexible exhaust fittings. Mounting shall be designed by the Manufacturer and secured to the building structure. Silencers shall be mounted so that its weight is not supported by the engine. Exhaust piping shall be stainless steel and sized as recommended by the manufacturer. Connection between engine and silencer shall be of flexible stainless steel.

B. Critical grade exhaust silencer, fully the equal of Maxim Model M51, with condensate drains and of the proper size for use with the engine, shall be furnished. It shall have a bottom inlet and top outlet with a 9 inch water column maximum pressure drop. Flexible, full length stainless steel connector shall be furnished. The generator set manufacturer shall furnish a wye connector with all appropriate fittings, flanges, etc., as required.

C. Exhaust silencer shall be mounted and insulated within the enclosure and pre-piped to the generator and exhaust stack.

D. Provisions shall be provided to allow the exhaust stack to be extended to the required overall height as required by the MassDEP. Additional roof re-enforcement shall be provided to support the weight of the exhaust stack extension. The exhaust stack shall be designed by the Manufacturer.

2.12 SHOP TESTING

A. The complete engine-generator set with enclosure shall be shop tested at full load using a resistive load bank to simulate a complete and integrated system prior to shipment.

B. Provide all details of the proposed testing, including arrangements, test instruments and calibration, and procedures to be used to verify controls and alarms. The completed certified test record shall be submitted within 30 days after the completed test.

C. Tests shall verify that unit will operate successfully and meet all specified operational requirements and verify adequate means of enclosure ventilation is provided.

D. The shop test shall include four continuous hours of operation at full load and varying power factor. Voltage and frequency regulation and transient response shall be tested and recorded to show full compliance with this specification. During the shop test, readings shall be taken and recorded every thirty minutes for each of the following:

1. Time.

2. Ambient temperature.

3. Volts for each phase.

4. Load:

   a. Amps for each phase.

   b. KW.

   c. Power factor.

   d. Frequency.

5. Engine jacket water temperature.

6. Lubricating oil pressure.

7. Exhaust gas temperature.

E. The procedure for the shop test of the engine shall cover the engine manufacturer's standard practice.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. General

1. Coordinate with ventilation, fuel supply, and exhaust, to provide an efficient, well coordinated layout.

2. Install unit complete and make operational.

3. Install muffler horizontally on spring type compensating hangers as close to unit as practical.

4. Provide 1/2-inch (12 mm) copper drain with draincock from bottom of muffler to nearest floor drain for periodic draining of muffler.

5. Install engine at sufficient height above base to permit dropping oil pan without removing unit.

6. Provide vibration isolation of exhaust equipment to prevent transfer of vibration into building components enclosing the standby power system.

7. External conduit and wiring and transfer switch will be furnished and installed under applicable electrical sections, but all conduit, wiring and connections between the engine and its control panel and generator and its control panel, is included herein.

8. Mount engine-generator set on a structural steel frame or skid. Provide vibration isolators suitable to prevent transmission of vibration to building structure between set and frame, and securely anchored to the concrete foundation. Obtain from supplier of engine-generator set a drawing giving location and size of foundation bolts for unit proposed, in sufficient time to be available when needed to place foundation. Galvanized anchor bolts shall be furnished by engine-generator set manufacturer.

9. Sheet metalwork and ventilating controls in connection with engine cooling are specified under Heating and Ventilating. External piping connections to engine shall be made with flexible armored hose furnished with engine.

10. Electrical equipment and materials shall be listed by UL wherever standards have been established by that agency.

D. Wiring and Connections

1. Provide conduit, wiring, and connections required and recommended by unit supplier. All conduit shall be terminated with flexible conduit. All wiring shall be multi-stranded.

2. Connect neutral point of generator and generator frame to ground by green insulated copper conductor of adequate size.

3. Connect motorized dampers in cooling and exhaust equipment to auxiliary contact on transfer controls to open dampers when unit is energized.

F. Equipment Start-up

1. Operate the unit to demonstrate ability to operate continuously without vibration, jamming, leaking or overheating and to perform specified functions, after installation and after manufacturer's representative check of installed equipment.

2. Comply with manufacturer's operating and maintenance instructions during start-up and operation.

3. Make all final adjustments necessary to place the equipment in working order. Prior to any testing or operation of the units, the manufacturer's service representative shall inspect the installation, and shall certify, in writing, that the assemblies are, in all ways, ready for operation. Start-up shall not commence without the presence of the manufacturer's representative.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer’s written instructions and in accordance with applicable codes, rules and regulations.

B. Field Test

1. Upon completion of the installation and as soon as conditions permit, the gas engine driven generator, including the engine, generator, electrical circuit controls, transfer controls other devices shall be tested in the presence of the Owner by the service representative for the manufacturer of the engine driven generator unit to verify that the system functions as specified.

a. Perform load test with a resistive load bank connected to the generator for a full load nameplate test. Run the test for a duration of four hours. Take system data readings each 30 minutes.

b. The manufacturers' representatives shall make such changes in wiring or connections and such adjustments, repairs or replacements to make the circuit, device or control system function as specified and comply with the Contract Documents.

c. Acceptance of test will be verified when the unit operates without alarm or abnormal conditions for the duration of the entire test. Retest if this requirement is not met until acceptance criteria has been verified.

2. Record in 20 minute intervals during four hour test:

a. Kilowatts

b. Amps

c. Voltage

d. Coolant temperature

e. Air temperature

f. Frequency

g. Oil pressure

3. As part of the field test, each of the automatic shutdown devices shall be tested and the respective values recorded at which the devices will stop engine. Any adjustments required shall be made in the devices to make the operating values correspond to those recommended by the engine manufacturer and as recorded during the stop test.

4. Take and record octave band sound pressure level readings while the engine driven generator is operating using the station load. These readings shall be within the limits identified in the engine generator data submittals for acceptable sound revel.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

B. Paint for exterior surfaces of equipment shall be two coats of acceptable oil- and heat-resistant paint, applied after surfaces have been thoroughly cleaned and prepared with suitable priming coat.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES

A. Services of Manufacturer, specifically trained on type of equipment specified and as follows:

1. Assist in location of devices, methods of mounting, field erection, etc. - 1/2 person-day.

2. Functional Completion Testing - 1 person-day.

3. Startup - 1 person-day.

4. Commissioning – 1/2 person-day.

B. Person-day is defined as one 8-hour day, excluding travel time. Person-day requirements listed exclusive of travel time.

C. Ensure that equipment manufacturer has local branch office staff with trained, full-time employees who are capable of performing testing, inspecting, repair, and maintenance services.

3.07 MANUFACTURER'S TRAINING

A. Services of Manufacturer, specifically trained on type of equipment specified and as follows:

1. At the end of start-up service provide for a maximum of six members of the owners staff at the facility site to receive training from the startup/testing service Engineer - 1 person-day.

B. Service-inspections during first year of operation, for use at Owner's request, and exclusive of repair, malfunction or other trouble-shooting service calls - 1 person-day.

C. Person-day is defined as one 8-hour day, excluding travel time. Person-day requirements listed exclusive of travel time.

3.07 LUBRICATION REQUIREMENTS

A. Provide all lubricating and operating oils required for the first year of operation..

3.09 SPARE PARTS

A. Provide spare parts as recommended by manufacturer for one year of operation for each engine-generator set plus following:

1. Two filter for all services.

2. Two fuse for each rating.

3. One set of spark plugs, ignition points and condensers.

B. Pack spare parts in suitable containers or boxes bearing labels clearly designating contents and piece of equipment for which they are intended.

C. Provide all special tools required for maintenance and repair of unit in metal box complete with lock and keys.

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

B. Contractor to ensure that conduit size and wire quantity, size, and type are suitable for the equipment supplied. Contractor to review the proper installation of the equipment and of each type of device with the equipment supplier prior to installation.

1. System Purging: After completing pressure tests, and before testing a gas contaminated line, purge line with nitrogen at junction with main line to remove all air and gas. Clean completed line by attaching a test pilot fixture at capped stub-in line at building location and let gas flow until test pilot ignites. Procedures shall conform to the specified Fuel Gas Code. CAUTION: Failure to purge may result in explosion within line when air-to-gas is at correct mixture.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF TEXT

ATTACHMENT A

ATTACHMENT A

TO SECTION 11396

Loads to be powered up by the engine-generator for engine generator load calculation. The Generator shall be capable of picking up the loads in order shown when operated manually.			
SWBD-1			
Equipment	**Total Quantity**	**Quantity Operating**	**HP/AMPS/kVA/kW**
Miscellaneous	1	1	15 kVA
P-1	1	1	60 HP* (68A/480 VAC/3PH)
P-2	1	1	60 HP* (68A/480 VAC/3PH)
* Motor is powered by variable frequency drive (VFD).			

SECTION 15195

NATURAL GAS PIPING SYSTEMS

PART 1 GENERAL

1.01 GENERAL PROVISIONS

A. Provide new existing gas piping system, complete and ready for operation. The Work of this Section shall include all labor, materials, tools, equipment and appurtenances, and performing all operations necessary to furnish and install complete and operable systems in accordance with this Section of these Specifications, the Drawings, and the codes and standards listed herein.

B. Coordinate with the Local Gas Utility as to any Local restrictions or requirements relative to the installation of the system.

C. Provide all gas piping upstream and downstream of gas meter/regulator outlets including meter/regulators and gas piping in accordance with the local gas utilities rules and regulations.

D. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. The gas company estimates charges of $20,000 charges for this service. Should the actual charges exceed or be less than the amount indicated, the difference will be paid by or returned to the Owner. A paid invoice from the gas company shall be submitted to the Engineer by the Contractor. Refer to SECTION 01020, ALLOWANCES.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Product Data - Annotate descriptive data to show the specific manufacturer, model, type, size capacity, options, etc. of each item.

a. Pipe and fittings

b. Valves

c. Gas equipment connectors

d. Regulators

e. Pipe hangers and supports

2. Certification - Submit documentation certifying completion of the following items in compliance with this Section.

a. Metal welding inspection

b. Piping pressure tests

c. System purging

3. Certificates and Licenses - Prepare as specified in Part 1 of this Section.

a. Qualifications of Installer

b. Qualifications of Construction Supervisor

4. Operation and Maintenance Manuals - Prepare manuals in accordance with SECTION 01030 - SPECIAL REQUIREMENTS.

   a. Valves

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 CODES, PERMITS AND FEES

A. Except for additional requirements as specified or indicated under the Work of this Section, materials, workmanship and equipment shall conform to the governing edition of the following regulations, and agency requirements. In the standards referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears.

   1. State and Local Building Codes including, but not limited to, 248 CMR 4.00 and 5.00 Massachusetts Fuel Gas Code, and 780 CMR Massachusetts Building Code.

   2. Local Fire Department

   3. Local Gas Utility

   4. Occupational Safety and Health Administration (OSHA)

   5. Any other local codes or requirements of Authorities Having Jurisdiction.

B. Pay for all fees and give all notices, file all plans, obtain all permits and licenses, and obtain all necessary approvals from Authorities Having Jurisdiction. Deliver all certificates of inspection to the Authorities Having Jurisdiction. No work shall be covered before examination and approval by Authorities Having Jurisdiction. Replace imperfect or condemned work to conform to inspectional requirements, satisfactory to the Architect, Owner, Engineer and Authorities Having Jurisdiction without extra cost to the Owner. If Work is covered before inspection and approval, pay costs of uncovering and reinstalling the covering, whether it meets contract requirements or not.

1.07 REFERENCES

A. Except as specified herein, the latest edition of the standards listed below form a part of this Specification to the extent referenced in this Section. Where earlier editions of standards are adopted as referenced in applicable codes, those shall govern. The publications are referred to within the text by the basic designation only.

B. In each of the standards referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16.33	Manually Operated Metallic Gas Valves for Use in Piping Systems up to 125 psig (Sizes 1/2 through 2)
ANSI B18.2.1	Square and Hex Bolts and Screws Inch Series
ANSI B109.1	Diaphragm-Type Gas Displacement Meters (Under 500 Cubic Feet per Hour Capacity)
ANSI B109.2	Diaphragm Type Gas Displacement Meters (500 Cubic Feet per Hour Capacity and Over)
ANSI B109.3	Rotary Type Gas Displacement Meters
ANSI Z21.41	Quick-Disconnect Devices for Use with Gas Fuel Appliances
ANSI Z21.45	Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
ANSI Z21.69	Connectors for Movable Gas Appliances
ANSI Z21.70	Earthquake Actuated Automatic Gas Shutoff Systems

ASME INTERNATIONAL (ASME)

ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.20.1	Pipe Threads, General Purpose, Inch
ASME B16.3	Malleable Iron Threaded Fittings
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	Forged Fittings, Socket-Welding and Threaded
ASME B16.38	Large Metallic Valves for Gas Distribution (Manually Operated, NPS 2 1/2 to 12, 125 psig Maximum)
ASME B16.39	Malleable Iron Threaded Pipe Unions
ASME B16.40	Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems
ASME B18.2.2.	Square and Hex Nuts

ASME B31.8 Gas Transmission and Distribution Piping Systems

ASME BPVC SEC VIII D1 Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASTM INTERNATIONAL (ASTM)

ASTM A 36 Carbon Structural Steel

ASTM A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 193 Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

ASTM A 194 Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service or Both

ASTM D 2513 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

ASTM D 2683 Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69 Pipe Hangers and Supports - Selection and Application

MSS SP-89 Pipe Hangers and Supports - Fabrication and Installation Practices

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

49 CFR 192 Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards

49 CFR 195 Transportation of Hazardous Liquids by Pipeline

1.08 QUALITY ASSURANCE

A. Qualifications of Installer

1. Prior to installation, submit data showing the name and license of the installing contractor and that he has successfully installed systems of the same type and design as specified herein. Data shall include names and locations of at least two installations of such systems. Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months. The installing contractor shall be licensed to perform applicable gas piping systems installation in the state in which the project is located.

2. Qualifications of Welders: Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. The Authority Having Jurisdiction shall be notified 24 hours in advance of any required testing and the tests shall be performed at the work site. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Prior to installation, submit data for approval showing the name and certification of each welder and welding operator to be used on the project. Submit each welder's identification symbols, assigned number, or letter, used to identify work of the welder. Welders making defective welds after passing a qualification test shall be given requalification test and, upon failing to pass this test, shall not be permitted to work on this Contract.

a. Steel Welder's Qualifications: Comply with ASME B31.8. Each steel welder shall have a copy of a certified ASME B31.8 qualification test report. Conduct a qualification test for each welder and submit results for approval.

b. Safety Standards: 49 CFR 192 and 49 CFR 195.

B. Qualifications of Construction Supervisor: Provide a Construction Supervisor with a minimum of 10 years of experience in fuel gas piping construction supervision who shall be responsible for the installation of the Work of this Section of the Specifications. The Construction Supervisor shall be licensed to perform applicable fuel gas piping systems supervision in the state in which the project is located. Prior to installation, submit data for approval showing the name and license of the Construction Supervisor.

1.09 REMOVAL WORK

A. Particular care shall be taken to avoid creating hazards on the site or causing disruption of service in the adjoining buildings.

B. All existing equipment indicated to be removed shall be done in a neat and workmanlike manner. All other equipment shall be removed from the premises.

C. Remove all abandoned piping and equipment not built into building construction. Where ceilings or walls are removed all abandoned piping shall be removed and ends of live services capped. Abandoned elements built into walls or located above existing ceilings shall remain and ends capped and marked abandoned.

D. Should any asbestos and/or asbestos related products or materials be encountered during the performance of the Work, stop work immediately and inform the Engineer and the Owner of the presence of asbestos.

PART 2 PRODUCTS

2.01 GENERAL

A. Branch piping to appliances or equipment shall be at least as large as the inlets thereof.

B. Where applicable, all products requiring approval by the Massachusetts Department of Public Safety shall be so approved.

2.02 PIPE AND FITTINGS

A. Aboveground Piping

1. Pipe: Black steel, ASTM A 53, Type E or S, Grade A or B, Schedule 40, threaded ends for sizes 2 inches and smaller; otherwise, plain end beveled for butt welding.

2. Threaded Fittings: ASME B16.3, black malleable iron.

3. Butt-Welding Fittings: ASME B16.9, with backing rings of compatible material.

4. Unions: ASME B16.39, black malleable iron.

5. Flanges and Flanged Fittings: ASME B16.5 steel flanges or convoluted steel flanges conforming to ASME BPVC SEC VIII D1. Flange faces shall have integral grooves of rectangular cross sections which afford containment for self-energizing gasket material.

a. Gaskets: Fluorinated elastomer, compatible with flange faces.

b. Bolting: Stainless steel; ASTM A 193, Grade B8M or B8MA, Type 316, for bolts; and ASTM A 194, Grade 8M, Type 316, for nuts. Dimensions of bolts, studs, and nuts shall conform with ANSI B18.2.1 and ASME B18.2.2 with coarse threads conforming to ASME B1.1, with Class 2A fit for bolts and studs and Class 2B fit for nuts. Bolts and bolt-studs shall extend through the nuts and may have reduced shanks of a diameter not less than the diameter at roof of threads. Bolts shall have American Standard regular square or heavy hexagon heads. Nuts shall be American Standard heavy semi-finished hexagon.

6. Pipe Thread Paste or Tape: Anti-seize and sealant paste or tape of polytetrafluoroethylene (PTFE).

7. Welding Filler Metal: ASME B31.8.

B. Risers - Manufacturer's standard riser, transition from plastic to steel pipe with 7 to 12 mil thick epoxy coating. Use swaged gas-tight construction with O-ring seals, metal insert, and protective sleeve. Provide remote bolt-on or bracket or wall-mounted riser supports.

2.03 VALVES, ABOVEGROUND

A. Shutoff Valves, Sizes Larger Than 2 Inch - Cast-iron body plug valve in accordance with ASME B16.38, non-lubricated, wedge-mechanism or tapered lift plug, and flanged ends.

B. Shutoff Valves, Sizes 2 Inch and Smaller - Bronze or Steel body ball valve in accordance with ANSI B16.33, full port pattern, reinforced PTFE seals, threaded ends, and PTFE seat.

2.04 GAS EQUIPMENT CONNECTORS

A. All gas equipment connectors shall be AGA-approved.

B. Flexible Connectors: ANSI Z21.45 and approved for use in Massachusetts.

C. Quick Disconnect Couplings: ANSI Z21.41.

D. Semi-Rigid Tubing and Fittings: ANSI Z21.69.

2.05 REGULATORS

A. AGA-approved, self-contained with spring-loaded diaphragm pressure regulating valve and atmospheric vent, corrosion resistant construction, pressure operating range as required for the pressure reduction for the equipment served , threaded ends for sizes 2 inch and smaller, otherwise flanged.

B. Regulators shall be designed for the gas used.

2.06 PIPE SLEEVES

A. Sleeves in Masonry and Concrete Walls, Floors, Ceilings and Flat Roofs: Standard Weight hot-dip galvanized steel, ductile-iron or cast-iron pipe sleeves.

B. Sleeves in Non-Masonry or Non-Concrete Walls, Floors, and Roofs: Hot-dip galvanized steel sheet, 26 gage minimum thickness.

2.07 PIPE ESCUTCHEONS

A. General: Provide pipe escutcheons at all pipe penetrations where penetration is exposed to view as specified herein with inside diameter closely fitting pipe outside diameter. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, wall, or ceilings; and pipe sleeve extension, if any. Escutcheons shall be held in place by internal spring tension or set screws.

B. Provide pipe escutcheons in finished spaces. Pipe escutcheons shall be of stainless steel, anodized aluminum or chrome-plated brass, solid or split hinged.

2.08 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

A. Provide all supplementary steel, factory fabricated channels and supports required for proper installation, mounting and support of all equipment and systems provided under this Section.

B. Supporting channels and supplementary steel shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for the specific loading on the system installed herein.

C. All supplementary steel shall be ASTM A36 factory-formed standard mill finished structural shapes, and shall be hot dipped galvanized after fabrication.

2.09 OTHER MATERIALS AND ACCESSORIES

A. Provide all other materials and accessories in accordance with the gas company's rules and regulations.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. Installation, workmanship, inspection and testing shall be in accordance with the specified Fuel Gas Code with the additions specified herein. Install piping straight and true to bear evenly on hangers and supports. Keep the interior and ends of new piping and existing piping affected by the Work thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter. Inspect piping before placing into position.

D. Piping shall not be permitted in Electrical Rooms and stairwells.

E. Piping and other apparatus shall not be installed in such a manner so as to interfere with the full swing of doors, movement of personnel and equipment, and access to other equipment.

F. Make provisions for pipe expansion and contraction with suitable anchors and offsets, expansion joints, or expansion loops. Make provisions in buried piping for differential settlement. Install piping to allow freedom of movement in all planes without imposing undue stress on any section of the main piping, branch piping, equipment and structure.

G Piping: Cut pipe to actual dimensions and assemble to prevent residual stress. Within buildings, run piping parallel to structure lines and conceal in finished spaces. Terminate each vertical supply pipe to burner or appliance with tee, nipple and cap to form a sediment trap. To supply multiple items of gas-burning equipment, provide manifold with inlet connections at both ends.

1. Cleanliness - Clean inside of pipe and fittings before installation. Blow lines clear using 80 to 100 psig clean dry compressed air. Rap steel lines sharply along entire pipe length before blowing clear.

2. Aboveground Steel Piping - Determine and establish measurements for piping at job site and accurately cut pipe lengths accordingly. For 2 inch diameter and smaller, use threaded or socket-welded joints. For 2 1/2 inch diameter and larger, use flanged or butt-welded joints.

   a. Threaded Joints: Where possible use pipe with factory-cut threads, otherwise cut pipe ends square, remove fins and burrs and cut taper pipe threads in accordance with ASME B1.20.1. Provide threads smooth, clean and full-cut. Apply anti-seize paste or tape to mail threads portion. Work piping into place without springing or forcing. Backing off to permit alignment of threaded joints will not be permitted. Engage threads so that not more than three threads remain exposed. Use unions for connections to valves for which a mean of disconnection is not otherwise provided.

   b. Welded Joints: Weld by the shielded metal-arc process, using covered electrodes and in accordance with procedures established and qualified in accordance with ASME B31.8.

   c. Flanged Joints: Use flanged joints for connecting welded joint pipe and fittings to valves to provide for disconnection. Install joints so that flange faces bear uniformly on gaskets. Engage bolts so that there is complete threading through the nuts and tighten so that bolts are uniformly stressed and equally torqued.

   d. Pipe Size Changes: Use reducing fittings for changes in pipe size. Size changes made with bushings will not be accepted.

3. Connections to Existing Pipeline - When making connections to live gas mains, use pressure tight installation equipment operated by workmen trained and experienced in making hot taps. For connections to existing underground pipeline or service branch, use transition fittings for dissimilar materials.

4. Wrapping - Where connection to existing steel line is made underground, tape wrap new steel transition fittings and exposed existing pipe having damaged coating. Clean pipe to bare metal. Initially stretch first layer of tape to conform to the surface while spirally half-lapping. Apply a second layer, half-lapped and spiraled as the first layer, but with spirals perpendicular to first wrapping. Use 10 mil minimum thick polyethylene tape. In lieu of tape wrap, heat shrinkable 10 mil minimum thick polyethylene sleeve may be used.

H. Valves

1. Install valves approximately at locations indicated. Orient stems vertically, with operators on top, or horizontally.

2. Stop Valve and Shutoff Valve - Provide shut-off valve at connection to each gas utilization appliance.

I. Gas Regulators - Provide ball valve ahead of each regulator. Install regulators inside buildings and extend a full-size vent line from relief outlet on regulator to a point outside of building. On outlet side of regulator provide a union and a 3/8 inch gage tap with plug.

J. Pipe Hangers and Supports

1. Selection, fabrication, and installation of piping hangers and supports shall conform with MSS SP-69 and MSS SP-89, unless otherwise indicated.

2. Furnish and install safe and substantial means of support for all parts of the piping system. Attach all pipes securely to the structure in correct alignment and pitch, to prevent vibration and to effectively care for expansion and contraction.

3. All piping shall be hung to true alignment, using appropriate hanger arrangements. Wire and strap hangers shall not be permitted. Hangers shall be located so that piping and hangers will be clear of other piping, hangers, conduits, lighting fixtures, equipment, ceiling suspension systems, ductwork and other obstructions.

4. Supplementary Steel and channels shall be firmly connected to the building construction in a manner approved by the Engineer, or as otherwise shown on the Drawings. Equipment and piping shall not be supported from metal decking, plaster ceilings, or similar structures.

K. Seismic Bracing Requirements - Piping and equipment shall be supported and braced to resist seismic loads where required by the specified Building Code. Provide seismic restraints in accordance with SMACNA Seismic Restraint Mnl except where otherwise required by the specified Building Code.

L. Pipe Through-Penetrations

1. Furnish pipe sleeves where pipe passes through walls, floors, ceilings, roofs, and partitions. Sleeves will be installed, secured in proper position and location during construction by the trade whose element will be penetrated. Such trades include concrete, and masonry. Core drilling of masonry and concrete may be provided by this Section in lieu of pipe sleeves when [cavities in the] core-drilled holes are completely [grouted] smooth. Furnish sleeves of sufficient length to pass through entire thickness of walls, floors, ceilings, roofs, and partitions.

2. Pipe Penetrations Through Building Interior Construction: Provide not less than 1/4 inch one inch space between exterior of piping and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. For non-fire rated assemblies, seal at both ends of the sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass. Seal both ends of penetrations through fire rated assemblies to maintain fire resistive integrity with UL listed fill, void, or cavity material.

3. Pipe Penetrations Through Building Exterior Construction: Provide a mechanically adjustable segmented elastomeric seal, with sleeve sized as recommended by seal manufacturer.

4. Extend sleeves in floor slabs 2 inches above the finished floor.

5. Seismic-braced pipe - Proper clearances between penetrating gas system piping and any barrier shall be provided. The penetration holes shall be sized such that the hole diameter is 2 inches larger for pipe diameters 1-inch nominal to 3-inch nominal, and 4 inches larger for 4 inch and larger nominal diameter pipe. All open space around seismically braced through-penetrations shall be protected by a Listed, flexible through-penetration seal system.

M. Final Connections: Make final connections to equipment and appliances using rigid pipe and fittings

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer's written instructions and in accordance with applicable codes, rules and regulations.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

B. Provide shop painting system, under this Section, of the following. Color of finish coat shall be yellow.

1. Hangers and supports in exposed locations.

2. Pipe, fittings and valves in exposed locations.

C. Do not apply paint until piping tests have been completed and approved by the Engineer.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES

A. Obtain instructions from the manufacturer for the proper method of installation and connection of the equipment that is to be installed. Obtain all information that is necessary to facilitate the Work and to complete the project.

3.03 MANUFACTURERS INSTRUCTIONS

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used.

3.09 SPARE PARTS – Not Used

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

B. Field Quality Control

1. Prior to initial operation, inspect piping systems for compliance with Drawings, Specifications and approved submittals. Perform pressure tests and purging in compliance with the specified requirements. Have piping approved by the Engineer before concealing.

2. Metal Welding Inspection - Inspect for compliance with the specified Fuel Gas Code. Replace, repair and then re-inspect defective welds.

3. Piping Pressure Tests

   a. Test system gas tight in accordance with the specified Fuel Gas Code with the additions specified herein. Use test pressure of 1 1/2 times maximum working pressure, but in no case less than 50 psig. Do not test until every joint has set and cool at least 8 hours at temperatures above 50 degrees F. Use clean dry air or inert gas, such as nitrogen or carbon dioxide, for testing. Systems which may be contaminated by gas shall first be purged as specified. Make tests on entire system or on sections that can be isolated by valves.

   b. After pressurization, isolate entire piping system from sources of air during test period. Maintain test pressure for at least 8 hours between times of first and last reading of pressure and temperature. Take first reading at least one hour after test pressure has been applied. Do not take test readings during rapid weather changes.

   c. There shall be no reduction in the applied test pressure other than that due to a change in ambient temperature. Allow for ambient temperature change in accordance with the relationship PF + 14.7 = (P1 + 14.7) (T2 +460) / T1 + 460), in which "T" and "P" represent Fahrenheit temperature and gage pressure, respectively, subscripts "1" and "2" denote initial and final readings, and "PF" is the calculated final pressure. If "PF" exceeds the measured final pressure (final gage reading) by 1/2 psi or more, isolate sections of the piping system, retest each section individually, and apply a solution of warm soapy water to joints of each section for which a reduction in pressure occurs after allowing for ambient temperature change. In performing tests, use a test gage calibrated in one psi increments and readable to 1/2 psi.

   d. Correct defects in Work and repeat test until no reduction in pressure occurs.

4. System Purging: After completing pressure tests, and before testing a gas contaminated line, purge line with nitrogen at junction with main line to remove all air and gas. Clean completed line by attaching a test pilot fixture at capped stub-in line at building location and let gas flow until test pilot ignites. Procedures shall conform to the specified Fuel Gas Code. CAUTION: Failure to purge may result in explosion within line when air-to-gas is at correct mixture.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16050

ELECTRICAL WORK – GENERAL

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations to provide a complete and operational systems at the Samoset Street Pump Station for both normal and standby electric power systems, lighting systems, grounding systems and other specified systems, including the installation and wiring of miscellaneous equipment and devices as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Perform all work and testing as indicated and specified. connection with the providing wires, cables and termination and identification materials for complete electrical systems, and other related items, as specified herein and as shown on the drawings.

1. Provide conduit, wiring and connections for power, control, lighting, instrumentation and alarms for equipment furnished by others unless otherwise specified and indicated.

2. Provide temporary circuits, overcurrent devices, conduit and wiring, and other equipment required during construction proposed electric system. Perform work at the convenience of the Owner.

3. Raceways supports and equipment anchoring shall be provided as specified in the Division 16 sections which form a part of the Contract Documents.

4. Electrically powered equipment and devices provided under other divisions and sections of the specifications are connected to the project specified electrical systems as part of the Electrical Work.

5. Provide a control panel with relays as required to control the ventilation louvers as specified sequence on the HVAC drawing.

D. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

B. The electric company estimates charges of $25,000 charges for this service. Should the actual charges exceed or be less than the amount indicated, the difference will be paid by or returned to the Owner. A paid invoice from the gas company shall be submitted to the Engineer by the Contractor. Refer to SECTION 01020, ALLOWANCES.

C. The telephone company estimates charges of $7,500 charges for this service. Should the actual charges exceed or be less than the amount indicated, the difference will be paid by or returned to the Owner. A paid invoice from the gas company shall be submitted to the Engineer by the Contractor. Refer to SECTION 01020, ALLOWANCES.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Drawings and Data: Include manufacturer's drawings, bills of material, panel and equipment layouts, catalog data, schematics diagrams, interconnection diagrams, wiring diagrams and other documentary or descriptive information as required for each assembly submitted in one package insofar as possible.

2. Bills of material: Include a numbered list of all components, with manufacturer's name, catalog number, rating, and other identification. Place item number or similar identification on all other drawings where item appears.

3. For informational purposes only, submit equipment installation instructions in separate submittals from other shop drawings.

4. Mark shop drawings and data submitted showing only items applicable to specific contract.

5. Include one-line diagrams, schematic diagrams, wiring diagrams, control sequence diagrams, relay diagrams, and metering. Submit only completed drawings showing all local and remote devices associated with each item. Submit one complete package of shop drawings. Partial submittals will be returned without action.

6. Submit time-current characteristic curves for all circuit breakers and fuses.

7. Submit instruction manuals for installation, operation, and maintenance of equipment, and parts list for equipment. Specifically mark standard publications forming a part of this contract. Cross out, blank out, or otherwise delete non-applicable items. Submittals which do not clearly indicate items and features provided shall be rejected.

8. Install permanent nameplates on all devices or pieces of equipment for which use or identification not readily apparent, such as starters, relays, contactors, pushbuttons, indicating lights, and switches. Ensure position of nameplates readable after equipment installation.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 REFERENCES

A. National Fire Protection Association (NFPA):

1. 70: National Electrical Code (NEC).

1.07 QUALITY ASSURANCE

A. Provide in accordance with Section 01400 and as specified.

B. Install electrical work in conformance with latest rules and requirements of Massachusetts Electrical Code and in accordance with requirements of State and Local Codes.

1.08 RELATED WORK

A. Conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under Divisions 11 and 13.

B. Conduit, wiring and terminations for all field-mounted instruments furnished and mounted under other Divisions, including process instrumentation primary elements, transmitters, local indicators and control panels. Install vendor furnished cables specified under other Divisions.

C. Review the electrical underground system and the civil yard piping. Install the electrical underground system in a manner that avoids conflicts with manholes, catch basins, etc. provided under other Divisions of the specifications.

D. Sequencing and Scheduling:

1. Coordinate electrical equipment installation with other pump station components.

2. Arrange for chases, slots and openings in the structures during the progress of construction to allow for the electrical installation.

3. Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

4. Sequence, coordinate and integrate the installation of electrical materials and equipment for efficient flow of the work. Coordinate the installation of large equipment requiring position prior to closing in the building.

E. Certain items of control equipment and other equipment are indicated on electrical drawings for connection, but are specified in other sections pertaining to mechanical process, instrumentation, etc. Such items are not furnished as part of electrical work.

1.08 INTERFERENCE AND ERRONEOUS LOCATIONS

A. Locations of electrical equipment, devices, outlets, and similar items, as indicated, are approximate only. Exact locations shall be determined during construction.

B. Verify in field, all data and final locations of work installed under other sections of specifications, required for placing of electrical work.

C. In case of interference with other work or erroneous locations with respect to equipment or structures, furnish all labor and materials to complete the work.

1.09 SEISMIC DESIGN REQUIREMENTS

A. Conform to the requirements indicated on the structural drawings and as specified in DIVISION 16, ELECTRICAL.

1.10 APPROVAL AND MARKING EQUIPMENT

A. Insure that devices and materials are listed and/or labeled by Underwriters' Laboratories, Inc., wherever standards have been established by that agency. Where Underwriters' Laboratories listing is not available for equipment, submit certified test reports of Nationally Recognized Testing Laboratory, approved by the local inspecting authority, indicating that equipment is in conformance with local code requirements or any other applicable requirements. Tests and inspections for approval of equipment shall be performed at no additional cost to Owner.

B. Clearly mark equipment, devices and material with name or trademark of manufacturer and rating in volts and amperes and other pertinent information on a nameplate.

1.11 ELECTRIC SERVICE

A. Earth and rock excavation, backfill, concrete masonry, concrete reinforcement, and construction joints required for electrical work is included under this section and shall conform to requirements specified under applicable sections of Contract for General Construction.

B. Electrical power system for the Samoset Street Pump Station operates at 480/277VAC, 3-phase, 4 wire, 60 Hertz.

1.12 INCOMING SERVICE

A. Contact the following organization for coordinating the incoming power requirements for the project:

NSTAR Electric

484 Willow Street

Yarmouth, MA 02673

Attn: Ms. Kathleen White

(508)-957-4525

B. The organization identified above will furnish and install:

1. Pole-mounted transformers on existing pole.

2. Connection of all secondary cables.

3. Utility meter

C. Provide the following in accordance with the contract documents:

1. Secondary ductlines between electrical main breaker and the utility pole.

2. Secondary cables of sufficient length for termination at the pole mounted transformers.

3. Grounding at service pole.

4. Conduit at service pole.

5. Metering socket in accordance with NSTAR standards.

6. Provide all conduit and wire to service pole, extend conduit up pole for distance of 10 feet, and leave sufficient length of conductors to reach the electrical distribution system overhead conductors. Connections at pole shall be made by the power company. Perform work at service pole in accordance with the power company's requirements.

D. Perform all work in accordance with power company's requirements and in manner approved by power company.

E. Notify power company, in writing, within two weeks after the contract award date concerning incoming service requirements.

F. The final, complete installation shall comply with all state and local statutory requirements having jurisdiction. The Contractor shall arrange for all necessary permits, pay all fees and arrange for all required inspections by local authorities. In general, all work shall comply with the requirements of the National Electrical Code, all state codes and the codes and ordinances of the city or town in which the work is to be done.

1.13 FAULT CURRENT AND ARC FLASH HAZARD LEVEL LABELING

A. Acquire the utility fault current availability from the utility, and provide label describing fault current availability at the meter socket. Affix label to meter socket.

1.14 CALCULATE THE ARC FLASH HAZARD LEVEL AT THE PANEL BOARDS

A. Perform a calculation to determine the arc flash hazard level at the panel boards.

B. Provide label describing the arc flash hazard at the required equipment. Label shall display the following information:

1. Available incident energy and the corresponding working distance

2. Minimum arc rating of clothing

3. Required level of personal protective equipment (PPE)

4. Highest hazard/risk category for the equipment

5. Nominal system voltage

6. Arc flash boundary

7. Shock hazard

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. Protection of Electrical Equipment

1. Protect electrical equipment from the weather, especially from water dripping or splashing upon it, at all times during shipment, storage, and construction. Do not store equipment outdoors.

2. Where equipment is installed or stored in moist areas, or unheated buildings, provide acceptable means to prevent moisture damage. Provide uniformly distributed source of heat in electrical equipment to prevent condensation and damage to electrical insulation systems.

D. Defective or Damaged Equipment

1. Defective and/or damaged equipment shall be replace at no additional cost to Owner.

E. Equipment Enclosure

1. The equipment enclosure classification of the plant areas are indicated on the drawings. Provide all equipment, devices and material meeting the requirements of the area classification schedule unless otherwise noted or specified.

F. Equipment Data List

1. Obtain data from the equipment supplier shop drawing submittals or equipment nameplates, and prepare a complete tabulation of all motors over 1/3 hp, and starting equipment for both, to be furnished on the project.

2. Include in tabulation firm the following information:

   a. Name and identification of equipment.

   b. Manufacturer.

   c. Horsepower or kilowatt rating.

   d. Voltage.

   e. Phase.

   f. Speed.

   g. Full load current.

   h. Locked rotor current or code letter.

   i. Type of enclosure (open drip-proof, totally enclosed, fan cooled, etc.).

   j. NEMA size of starter or contactor.

   k. Overload heater size.

   l. Type of starter (full-voltage, reduced-voltage, autotransformer, etc.).

   m. Breaker trip setting or fuse size.

   n. Voltage of starter operating coil.

   o. If starter is at a motor control center, list motor control center number.

G. Drawings and Specifications

1. Drawings and specifications are typical of work to be done and of the arrangement desired.

2. At the completion of the project, provide two sets of drawings that are marked to show the as-installed equipment, devices, duct line locations and wiring. These sets are to be provided to the Owner. The markings on the drawings are to be neat, clean and legible.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer's written instructions and in accordance with applicable codes, rules and regulations.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES – Not Used

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used

3.09 SPARE PARTS – Not Used

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16110

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with the providing raceways and boxes for electrical systems, and other related items, as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Provide complete raceway systems, with matching accessories, fittings, boxes, and other hardware, as indicated and specified. When non-metallic raceway systems are specified, provide green insulated grounding conductor sized per Massachusetts Electrical Code (MEC) requirements.

D. All raceway runs are indicated diagrammatically to outline general routing of raceway. Unless specifically identified for installation in concrete walls or slabs, raceways shall be run exposed with raceway supporting systems. Avoid interfering with pipes, ducts, structural members, or other equipment. Any installation deviations from the contract requirements shall be corrected at no cost to Owner.

E. Provide raceway systems in accordance with the following:

1. In areas designated NEMA 4X, use galvanized rigid steel raceway systems.

2. In classified hazardous areas and areas designated NEMA 7, use PVC coated rigid steel with tapered threads and sealing fittings as required by the NEC for hazardous applications.

3. Inside concrete slabs or walls, use PVC Schedule 40 raceway systems.

4. Use Type 316 stainless steel support systems for exterior applications.

F. All raceway systems shall be installed in accordance with the criteria described in this section. Any proposed deviations from these requirements shall be submitted in writing for review and disposition.

G. Aluminum conduit and boxes are not acceptable products.

H. ll raceways shall be supported to NEC requirements and to meet all applicable seismic criteria. Raceways 2 inch (50 mm) outside diameter or greater shall be independently supported in a manner to meet the criteria to resist failure during earthquake events.

I. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 REFERENCES

B. National Electrical Manufacturers Association (NEMA):

1. RN-1: Polyvinylchloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

2. TC-2: Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)

3. TC-3: Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

C. National Fire Protection Association (NFPA):

1. 70: National Electrical Code (NEC).

2. Massachusetts Electrical Code (MEC)

D. Occupational Safety & Health Act (OSHA).

1. Regulation 1910.7

E. Underwriter's Laboratories, Inc. (UL):

1. 1: Electrical Flexible Metal Conduit

2. 6: Rigid Metal Electrical Conduit

3. 94: UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

4. 360: Electrical Liquid-Tight Flexible Steel

5. 651: Schedule 40 and 80 PVC Conduit

6. 886: Electrical Outlet Boxes and Fittings for Use in Hazardous Locations, Class 1, Groups A, B, C, and D and Class 11, Groups E, F, and G

7. 1684: UL Standard for Safety Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

1.07 SEISMIC DESIGN REQUIREMENTS

A. Conform to the requirements indicated on the structural drawings.

B. It shall be the responsibility of manufacturer and supplier along with the Electrical Contractor to conform to the seismic design requirements for this project and for the work of this specification section.

C. Install supports for raceway systems greater than 2 inches (50 mm) in diameter to meet the seismic requirements indicated and specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Rigid Metal Conduit, and polyvinylchloride-coated rigid steel conduit.

1. Triangle/PWC, Inc.

2. Perma-Cote Industries.

3. Republic Steel Corporation.

4. Robroy Industries.

5. Allied Tube and Conduit.

B. Polyvinylchloride (PVC) Conduit

1. Triangle/PWC, Inc.

2. Robroy Industries.

3. Carlon Electrical Sciences, Inc.

C. Flexible Conduit

1. American Flexible Conduit Company.

2. Anamet, Inc.

3. Electri-Flex Company.

4. International Metal Hose Company.

D. Boxes and Fittings

1. O.Z./Gedney Company.

2. Crouse-Hinds Electrical Construction Materials.

3. Appleton Electric Company.

E. Fiberglass-Reinforced Polyester Boxes

1. Crouse-Hinds Electrical Construction Materials.

2. Fibox.

3. Hoffman Engineering Company.

4. Vynckier Enclosure Systems.

F. Support Systems

1. Michigan Hanger Co., (O-Strut).

2. Thomas & Betts (Superstrut).

3. Unistrut Corp.

2.02 MATERIALS AND COMPONENTS

A. Rigid Metal Conduit

1. Provide galvanized rigid metal conduit, each with a coupling on one end and thread protector on other end.

2. Hot-dip galvanize rigid steel conduit over entire length, along interior and exterior surfaces, including threads. Conduit shall conform to UL 6.

B. Flexible-Metal Conduit

1. Provide flexible-metal conduit for use in dry areas and match fittings, size, and material to rigid conduit to which it is connected. Flexible-metal conduit shall conform to UL 1.

2. Provide liquid-tight flexible-metal conduit for use in damp areas consisting of flexible-metal conduit, with liquid-tight, sunlight-resistant jacket extruded over the conduit. Provide stainless steel, braided flexible conduit in NEMA 4X, corrosive areas. On larger than 1-1/4 inch (30 mm), furnish separate external ground wire. Liquid-Tight flexible-metal conduit shall conform to UL 360.

C. Polyvinylchloride (PVC) Conduit

1. Provide PVC conduit, Schedule 40 and Schedule 80 conforming to NEMA Standard TC-2 and UL-651.

2. Fittings and Conduit Bodies: NEMA TC 3 as recommended by the conduit manufacturer.

D. Polyvinylchloride-Coated Rigid Steel Conduit

1. Provide polyvinylchloride-coated (PVC-Coated), rigid steel conduit conforming to NEMA Standard RN-1 consisting of hot-dipped galvanized rigid steel conduit, as specified hereinbefore, with a polyvinylchloride jacket bonded to the outside of all conduit surfaces with a nominal thickness of 40 mils meeting the requirements of NEMA RN-1, 3.1. The adhesive strength of the bonding to equal or exceed tensile strength of the coating. Provide couplings and fittings for this conduit conforming to the requirements of NEMA RN-1, 3.5.

2. A two-part urethane coating shall be applied to the interior of all conduit and fittings at a two mil thickness. The interior coating shall be flexible to allow field bending without cracking or flaking.

E. Boxes

1. Provide boxes containing fixture studs for hanging fixtures. Use concrete-tight boxes for installation in concrete. Do not use shallow boxes unless building construction is such that it is impossible to use standard-depth boxes.

2. Provide outlet boxes and fittings for hazardous locations conforming to UL 886 for class, group, and division indicated.

3. Provide boxes and covers for polyvinylchloride-coated steel conduit made of fiberglass reinforced resin. Boxes shall have hubs with extruded sleeves extending beyond the hub in the same manner as specified for conduit couplings. Provide cover screws of stainless steel.

4. Provide cast boxes with covers or device plates suitable for the area classification. Use cover screws of stainless steel or high brass for iron boxes.

5. Provide polyvinylchloride boxes for use as junction boxes and provide high impact strength fiberglass-reinforced polyester boxes for use as device boxes, pull boxes, and terminal boxes for use with polyvinylchloride conduit. Size each box as required by the NEC.

F. Fittings

1. Provide cast-iron fittings of malleable iron or a mixture of gray iron and cast steel.

2. Provide suitable expansion fittings where conduits cross expansion joints. Equip these fittings with grounding straps, clamps, and copper bonding jumpers.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. Perform all work in accordance with the NEC.

D. Use no conduit less than 3/4-inch (20 mm) in diameter, unless otherwise indicated.

E. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's printed instructions.

F. Seismic Restraints

1. For conduits and other raceways installed in open areas, not adjacent to and secured to structural elements, and 2 inch (50 mm) outside diameter or greater, support such raceways using seismic restraints rated for the applicable project earthquake criteria.

2. Methods of Restraining Raceways

a. Utilize threaded rod with rod stiffeners and transverse channel braces at approximately 45 degrees angle, at 15 feet (4.5 m) on center, maximum, and on one side of rod support.

b. Utilize longitudinal bracing with channel braces at 30 feet (9.1 m) on center, maximum.

c. Strap raceways directly to transverse channel braces, using pipe strap with both ends of strap bolted into the channel brace.

d. Do not rigidly brace raceways to different parts of a building that may respond differently during an earthquake. Seismic restraints shall not limit expansion and contraction of the raceway support system.

e. Provide flexible connections for conduits 2 inch (50 mm) outside diameter or greater than when terminating to fixed equipment to prevent loss of raceway integrity in the event of an earthquake.

G. Fittings

1. Do not install fittings to replace elbows and pull boxes, unless space or other problems make use of fittings necessary. Use oversize fittings whenever large cable is installed, in order to maintain proper bending radius.

2. Terminate ends of all conduits installed for future use with couplings and readily removable plugs set flush with finished floor surface. Cap spare wall conduits at wall where they enter building.

3. Equip ends of all conduits with conduit fittings. Fit conduits terminating at power distribution equipment, or in box above or below, with grounding type bushings, or solidly ground by locknuts or other acceptable fittings. Connect each grounding bushing to ground bus by a bare or green-covered copper wire. Do not use ground wire smaller than 12 AWG. Install ground wire larger than 12 AWG when required by NEC. Where conduits terminate in unprotected areas or where bonding is required over expansion joint, flexible conduit or equivalent; use ground wires 6 AWG. copper or larger.

4. Terminate conduits entering gasketed sheet-metal boxes or gasketed sheet-metal equipment enclosures with gasketed hubs.

5. Terminate conduits entering nongasketed sheet-metal boxes or enclosures with double locknuts and insulated bushings, or with acceptable equivalent.

6. Join raceways with fittings listed for the purpose. Make joints tight. Use raceway fittings compatible with raceway and suitable for use and location.

7. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.

8. Use insulating bushings to protect conductors.

9. Tighten set screws of threadless fittings with suitable tool.

H. Raceways

1. Install exposed raceways parallel or at right angles to walls and ceiling beams. Make all changes in directions with listed bends, elbows, and pull boxes. Space parallel runs uniformly throughout. Secure in place by hangers and fasteners. Ground raceways by connection to properly grounded enclosures, bonding, or other means, to obtain permanent low resistance path to ground throughout installation. Ensure that raceway sections in single run and in parallel runs are of same type and finish.

   a. Run parallel or banked raceways together, on common supports where practical.

   b. Install raceways level and square and at proper elevations. Provide minimum 7 feet (2 m) headroom.

2. Provide cast-in-place inserts in concrete to support all runs, unless otherwise permitted. Use stainless steel sleeve type concrete anchors for installing boxes, and conduit supports. Provide Type 316 stainless steel nut, bolts, and washers, for use with concrete anchors.

3. Support conduits by hangers or pipe straps spaced according to NEC, but in no case more than 10 feet (3 m) on centers.

4. Provide hot-dipped galvanized supports for galvanized conduit.

5. When specified on the Contract Drawings, install conduits in slabs as close to middle of concrete slabs as practicable without disturbing reinforcement. Do not use conduit with outside diameter exceeding one-third of slab thickness. Do not place conduits closer than three diameters on centers, except at cabinet locations where slab thickness is increased as permitted by Engineer.

6. Stub-Up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs, and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit. Flexible metal conduit may be used 6 inches (150 mm) above the floor. Cap spare wall conduits at wall entrance to building.

7. Provide sleeves passing through walls which are wall entrance seals of watertight construction. For new construction, furnish watertight seal between slab and sleeve, and between sleeve and conduit or cable similar to O.Z./Gedney Type "FSK".

8. Do not use dissimilar metals in conjunction with each other. Use an insulation between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. Maintain electrical continuity of system. Use bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials as insulation.

9. Install fittings to match raceway being used.

10. Provide separate raceways for all low voltage instrumentation raceways (50 volts and below) from control and power raceways.

11. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box; use two locknuts, one inside and one outside the box.

12. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

13. Install pull wires in all empty raceways. Use 14 AWG zinc-coated steel or monofilament plastic line having not less than 200 lb (890 N) tensile strength. Leave not less than 12 inches (300 mm) of slack at each end of the pull wire.

14. Complete raceway installation before beginning conductor installation.

15. Use temporary closures to prevent foreign matter from entering raceway.

16. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

I. Bends

1. Make all bends carefully to prevent distortion of circular cross section. Field bend conduit shall have an inside radius of not less than nine diameters.

2. Where bends of less than nine diameters are necessary, use standard factory elbows. Size conduit to permit cable-bending radius within the factory elbow of at least eight times cable diameter.

3. Allow no conduit greater than 50 feet (15.2 meters) to have more than two 90 degree bends or equivalent thereof between pulling points. For conduits less than 50 feet (15.2 meters) in length, allow only three 90 degree bends between pulling points.

J. Cutting, Threating and Connecting

1. Make all field cuts in conduits squarely, file cut ends, ream to remove rough edges and thread in accordance with NEC. No running thread permitted. Make all connections mechanically strong and tight, and with acceptable connectors. Where conduit surface coating is damaged or removed in the cutting, threading or reaming process, restore the surface to its original condition.

K. Conduit Cleaning

1. Clean all conduit carefully before and after installation, ream ends free of burrs, and free inside surfaces from all imperfections likely to injure cable.

2. After installation of each complete new conduit run, snake the run with band to which is attached a tube cleaner with cylindrical mandrel of a diameter not less than 85 percent of nominal diameter of conduit. Remove and replace all conduit through which mandrel will not pass.

3. Use a sponge with steel brush to clean steel conduit and use a sponge with nylon brush to clean PVC conduits.

4. After cleaning, protect ends of all conduit with standard caps to prevent entrance of water, concrete, debris, or other foreign substance.

L. Conduit Drainage

1. Where practicable, pitch conduit to drain to outlet boxes, or install so as to avoid trapping moisture. Where dips are unavoidable in exposed conduits, install fitting with drain hole at low point.

M. Boxes

1. Unless otherwise indicated, install sheet metal boxes only in dry, accessible locations. Install cast-metal boxes in exterior concrete or masonry walls, in floor slabs, in basements, all other below grade locations and elsewhere as indicated. Cast metal boxes shall be used (unless otherwise indicated) where vapor-tight fixtures are required, for all surface mounting of wall switches and receptacles and for all outdoor use. Install pull boxes for motor control centers and large ceiling hung boxes where indicated.

2. Install boxes in conformance with all the requirements of NEC. Install boxes designed for type of construction involved. Support boxes in same manner as required for conduit. Size boxes to provide bending radius for wire or cable of at least eight times diameter or in accordance with NEC, whichever is larger.

3. Center all outlets in panels, or spaces and adjust to structural finish. Where specific locations are not indicated, locate outlets with respect to equipment served.

4. Assemble cast-metal boxes with threaded conduit hubs in such manner that conduit connections and gasketed covers are watertight. Close all unused threaded openings with pipe plugs and compound.

5. Provide cast boxes with covers and device plates suitable for the area classification. Install screws of stainless steel or high brass for iron boxes.

N. Flexible Connections to Motors and Equipment

1. At all motors and electrically operated equipment to which conduit connections are made, install with a complete connection between end of conduit and terminal box of motor or other equipment.

2. Install the conduits in locations permitting direct connection to motors.

3. Make connections between rigid raceway and motor or equipment subject to vibration and adjustment using flexible conduit. Make each connection with at least one quarter bend so that no vibration can be transmitted beyond flexible connection.

4. Install flexible metal conduit, fittings, and accessories in dry areas in accordance with requirements of NEC.

5. Install liquid-tight flexible metal conduit in damp and corrosive areas. Locate conduit to reduce the possibility of damage to the exterior coating. Use fittings that screw into flexible conduit and provide gaskets.

O. Hazardous Areas

1. Install all conduits, fittings, equipment and devices within areas to comply with requirements of NEC for Hazardous Locations, Class, Division, and Group as indicated on the drawings.

2. In such hazardous locations, seal conduits terminating at boxes enclosing circuit-opening equipment at entrance to enclosure with compound-filled, commercial, sealing fittings to prevent passage of explosive or combustible gases through conduits.

3. Seal all conduits leading from or entering such hazardous locations at points of exit or entrance with two-part epoxy sealant.

4. Install conduit connections with at least five threads tightly engaged, and made up with suitable thread compound.

5. Where drain/seal fittings are required, they shall be of malleable iron construction with an internal drainage path which provides a visual means to ensure that the compound chamber is properly filled. The installation shall enable the drain/breather fitting and filler plug to be installed right after the compound is poured.

P. Protection

1. Provide protection and install in accordance with manufacturer printed instructions. The conduit and raceway equipment manufacturers, to ensure that coatings, finishes, and enclosures are without damage or deterioration at completion of project.

   a. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

   b. Repair damage to PVC or paint finishes with matching touch-up coating recommended by the manufacturer.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer's written instructions and in accordance with applicable codes, rules and regulations.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES – Not Used

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used.

3.09 SPARE PARTS – Not Used

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

B. Items provided under this section shall be listed and labeled by UL or other Nationally Recognized Testing laboratory (NRTL).

   1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

   2. Terms "listed" and "labeled" shall be as defined in NFPA 70, National Electrical Code, Article 100.

C. Regulatory requirements

   3. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

B. Final System Acceptance

1. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions and at no additional cost to the Owner.

2. Label all raceways and boxes in accordance with the requirements of SECTION 16050. ELECTRICAL WORK – GENERAL.

END OF SECTION

SECTION 16120

ELECTRIC WIRES AND CABLES

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with the providing wires, cables and termination and identification materials for complete electrical systems, and other related items, as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Perform tests on installed wire and cables in accordance with SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS.

D. Provide fire stops for all electrical penetrations routed through fire rated walls and floors.

E. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Cables

2. Terminations

3. Terminal blocks

4. Lugs

5. Connectors

6. Fire proofing tape

7. Identification tags

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. B3: Soft or Annealed Copper Wire.

2. B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

3. B33: Tinned Soft or Annealed Copper Wire for Electrical Purposes.

B. Local Codes.

C. National Fire Protection Association (NFPA):

1. NFPA-70: National Electrical Code (NEC).

D. Underwriters Laboratories, Inc. (UL):

1. U.L. 44: Wires and Cables Rubber Insulated.

2. U.L. 83: Wires Thermoplastic-Insulated.

3. U.L. 854: Cables, Service Entrance.

4. U.L. 1479: Fire Tests of through Penetration Firestops.

E. National Electrical Manufacturer's Association (NEMA):

1. WC 5: Thermoplastic Insulated Wire & Cable.

2. WC 8: Ethylene-Propylene-Rubber-Insulated Wire & Cable.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. 600V Cable:

1. Pirelli Cable Corporation.

2. Okonite.

3. The Rockbestos Company.

B. Metering and Instrumentation Wire, 600V:

1. The Rockbestos Company.

2. Okonite.

3. Pirelli Cable Corporation.

C. Cable Fireproofing Tape:

1. MAC Products, Inc.

2. 3M Company.

3. Thomas & Betts Company.

2.02 MATERIALS AND COMPONENTS

A. Material and stranding of conductors to conform to ASTM B3, ASTM B33, and to ASTM B8.

B. Wires and Cables for Maximum 600-Volt power: Furnish copper conductors. For No. 8 and smaller, provide THWN/THHN type cable. Provide No. 6 and larger as XHHW-2. Provide No. 12 and No. 10 AWG as solid conductor. Provide No. 8 AWG and larger as stranded conductor. Provide wires and cable conforming to UL 83.

C. Wires and Cables for Maximum 600-Volt control, indicating, metering, or alarm circuits: Furnish copper conductors, type THWN/THHN stranded, rated 75C with thermoplastic insulation and nylon jacket. Provide wires and cable conforming to UL 83. Cables used in fire alarm circuits shall be listed per the requirements of Article 760 of NEC.

D. Shielded Cable for Instrumentation Wiring: Provide 19-strand tinned copper conductors, size No. 16 AWG. Insulate conductors individually with color coded polyethylene or polyvinylchloride. Twist pairs twisted with varying lay (if more than one pair) and cover with cable tape and copper or aluminum coated mylar shielding tape and tinned copper drain wire. Jacket shall be polyvinylchloride. Cables shall be rated 600 volts and 90 degrees C.

E. Category 5e Cable: Category 5e cable shall consist of 4 twisted pairs of different lay and ground wires, enclosed by an overall conductive mylar backed aluminum foil shield. This shall be enclosed by an overall thermoplastic jacket. The cable shall meet the applicable requirements of ANSI/TIA/IEA-568-B.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. General

1. Provide all material, equipment, and labor to install the electric wire and cables as indicated and as specified.

2. Provide power cable identification as follows:

System Voltage	Neutral	Phase A	Phase B	Phase C
208/120V	White	Black	Red	Blue
240/120V	White-Gray Stripe	Black- Blue Stripe	Red- Blue Stripe	None
480/277V	Gray	Brown	Orange	Yellow

3. Use green to identify insulated ground conductors.

NOTE: Colored insulation, tapes or sleeves may be used to provide color coding but they must be installed on all conductors at all pull and junction boxes. Insulated ground conductors must have green insulation.

4. Permanently post means of identification of grounded and ungrounded conductors for each nominal voltage system at each panel board.

5. Provide control, indicating, metering or alarm cable identification as follows:

a. AC Control Red

b. DC Control Blue

D. Wiring

1. Provide wire and cable sizes as indicated. However, in no case use smaller cable sizes than required by the National Electrical Code.

2. Unless otherwise indicated, use no conductor smaller than No. 12 AWG for power, No. 14 AWG for control, and No. 16 AWG for shielded applications.

3. Install conductors continuous from outlet to outlet and make no splices except within outlet or junction boxes.

4. There shall be no splices between connection points.

5. Draw all conductors contained within a single conduit at the same time.

6. Apply wire pulling compound to conductors being drawn through conduits.

7. Use no cable bend with radius of less than eight times its diameter.

8. Pull cables in underground conduit system without splices. Use lubricants recommended by the cable manufacturer. Do not exceed maximum pulling tension specified by the manufacturer. Use a gauge to measure pulling tension to insure that the recommended limit is not exceeded.

9. Wrap cables in manholes on an individual cable basis with fireproof tape 2 inches wide. Extend fireproofing 1-inch into any duct. Install tape in accordance with manufacturer's instructions.

E. Conductor Identification

1. Label each wire at both termination points. Label each wire at each end using equipment tag and circuit number where wire is coming from. Carry individual conductor or circuit identification throughout.

2. Identify each wire in junction boxes, cabinets, and terminal boxes. Where no termination is made use a plastic-coated, wire marker and where termination is made use a, plastic, pre-printed sleeve wire marker.

3. In cases where terminal boards are provided for the control, indicating, and metering wires, identify all wires including motor leads and other power wires too large for connection to terminal boards, by sleeve wire markers as specified above.

4. In manholes and handholes, identify each power wire by laminated plastic tag with "to" and "from" destinations identified. Tags shall be located to be visible. Control wires to be bundled and marked with "to" and "from" destinations identified.

F. Connectors, Terminal Lugs and Boards

1. For wiring of circuits consisting of No. 10 or No. 12 AWG solid wires, such as for lighting branch circuits, utilize self-insulated pressure type connectors for all splices or joints.

2. Terminate all wires and conductors by means of ring and tongue, nylon self-insulated, tin-plated copper pressure terminals.

3. Fabricated terminal boards, installed where indicated, of type 600 volts and rated for 125 percent of the ampacity of the connected circuit. They shall have screw terminals, with white marking strips for wire identification, of the 4-, 6-, 8-, or 12-pole type.

4. Mark terminal strips with ink or indelible pencil. Mark each wire consistently throughout entire system, using notation of wires given on manufacturer's wiring diagrams.

5. Wire connections for which terminals are not supplied, for example, at solenoids or motor terminal junction boxes:

   a. 10 AWG and smaller: Use self insulated pressure-type connectors.

   b. 8 AWG and larger: Use insulated, mechanical type with set screw or follower bearing directly on the wire. Split bolt connectors are not acceptable.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer's written instructions and in accordance with applicable codes, rules and regulations.

B. Field Cable Tests

1. Perform cable testing in accordance with SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES – Not Used

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used.

3.09 SPARE PARTS – Not Used

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16160

PANEL BOARDS

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with providing panel boards including circuit breakers, Surge Protection Devices (SPD) and cabinets complete, and other related items, as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Surge Protection Devices (SPD) shall be integral to the panelboard cabinet. SPD shall be as specified in SECTION 16400 - SURGE PROTECTION DEVICES (SPDs).

D. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 REFERENCES

A. Federal Specifications (FS):

1. QQ-S-365B: General Requirements for Silver Plating, Electro Deposited

2. W-P-115A: Panel, Power Distribution.

B. National Electrical Manufacturers Association (NEMA):

1. 250: Enclosures for Electrical Equipment (1000 volts maximum)

2. AB 1: Molded Case Circuit Breakers

3. PB 1: Panelboards

C. National Fire Protection Association (NFPA):

1. 70: National Electrical Code (NEC)

D. Underwriter's Laboratories, Inc. (UL):

1. 50: Cabinets and Boxes

2. 67: Panelboards

3. 86A: Wire Connectors and Soldering Lugs for Use with Copper Conductors

4. 489: Circuit Breakers, Molded Case and Circuit Breaker Enclosures

1.07 QUALITY ASSURANCE:

A. All panelboards shall be designed, manufactured and assembled in accordance with the referenced standards.

B. Listing and Labeling: All panelboards shall be listed and labeled by Underwriter’s Laboratories, Inc. (UL), or other nationally-recognized testing laboratory (NRTL).

C. Service Entrance panelboards shall be UL/NRTL-labeled as suitable for that purpose.

D. Single-source Responsibility: Provide panelboards products that are new, and from the same manufacturer for each building or job. Panelboard components shall be from the same manufacturer, or listed as an assembly thereof.

PART 2 PRODUCTS

2.01 PANELBOARD MANUFACTURERS

A. Manufacturers acceptable contingent upon products' compliance with the specifications:

1. Eaton Cutler-Hammer

2. General Electric

3. Siemens

4. Schneider Square D.

2.02 PANELBOARDS

A. Factory assembled deadfront type panelboards.

B. Furnish panelboards complete with branch circuit breakers and a main circuit breaker or main lugs only as indicated.

C. Furnish panelboards with full capacity separate ground bus, separate insulated neutral bus and furnish panelboards connected to a 3 phase, 4 wire service or single phase, 3-wire service as indicated.

D. Provide panelboards with the voltage, frequency and current ratings as indicated conforming to NEMA Standard PB1, Federal Specification W-P-115A. U.L. 67, and the NEC.

E. Furnish the panelboard main and neutral buses, with minimum 98 percent conductivity rectangular copper bars provided with bolted type lugs as necessary.

F. Drill buses to fit either "A", "B" or "C" Phase connectors, and ensure that connectors are interchangeable and installed in a distributed phase sequence.

G. Silver plate buses, connectors and terminals to a minimum thickness of 0.005-in., conforming to the requirements of Federal Spec. QQ-S-365B.

H. Prevent terminal lugs from turning per NEMA standard PB 1 and ensure they are suitable for the conductor material and size.

I. Provide main bus-bracing for each panel board adequate for 10,000 amperes symmetrical short circuit at 240 volts unless otherwise indicated.

J. Where the word “space” occurs on panel schedules, provide all necessary hardware in the space, including connection straps, mounting brackets, and filler plates so that only the addition of a future circuit breaker is required. Connection straps shall be rated a minimum of 100A in panelboards of 400A rating or less and a minimum of 225A in panelboards above 400A rating, unless otherwise noted on panel schedules.

K. Provide integral transient Surge Protection Device (SPD) in accordance with SECTION 16400, SURGE PROTECTION DEVICES (SPGs) where indicated on the drawings.

2.03 CIRCUIT BREAKERS:

A. Each circuit breaker shall be bolted into position in the panelboard, whether by direct bolted connection to the bus or by being bolted to the panelboard frame. Each circuit breaker shall be replaceable without disturbing adjacent units. Plug-on circuit breakers held in place only by spring force of the bus lug and the pressure of the deadfront are not acceptable.

B. Furnish frame sizes, trip settings and number of poles as indicated. Clearly and visibly mark circuit breakers with ampere trip rating. Furnish breakers meeting the requirements of F.S. W-C-375B and NEMA AB1.

C. Furnish all breakers with quick-make, quick-break, toggle mechanisms and thermal-magnetic, inverse time-limit overload and instantaneous short circuit protection on all poles, unless otherwise indicated. Automatic tripping indicated by the breaker handle assuming a clearly distinctive position from the manual ON and OFF position. Furnish breaker handle that is trip-free on overloads.

D. Do not use single pole breakers with handle ties or bails in lieu of multi-pole breakers.

E. For each panelboard, furnish quantity four handle lock devices for individual breakers to prevent the manual opening of the selected breakers. Turn devices over to Owner at completion of the project work.

F. Ensure that voltage and interrupting rating of all breakers in a panelboard is not less than voltage and short circuit rating of the panelboard main buses, as indicated. Furnish breakers suitable to operate satisfactorily at the frequency indicated.

G. Furnish ground fault interrupter (GFI) circuit breakers for certain circuits as indicated on the drawings.

H. Furnish single pole breakers with full module size. Do not install two pole breakers in a single module.

I. Furnish time-current characteristic curves and catalog information and data for each size of breaker furnished.

2.04 CABINETS

A. Provide cabinets with NEMA enclosure type as indicated and without knockouts. Drill cabinets only for the exact conduit entrances and mounting bolts.

B. Finish cabinet fronts, trims and surface-mounted boxes in ANSI No. 61 or 49, light-gray enamel over a rust-inhibitive primer. Attach the fronts (exterior trims) to the boxes or interior trims, by quarter-turn, indicating trim clamps. Design cabinets for surface or flush mounting as indicated.

C. Unless otherwise specified, construct panelboard cabinets of code-gauge galvanized, sheet steel and equip with gutters of ample size for the risers and outgoing circuits.

D. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the Owner’s option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.

2.05 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. Mount panelboards, plumb and rigid without distortion of the box. Mount such that the height of the top operating handle does not exceed 6 feet 7 inches (2 m) from the floor.

D. Hang each door of the cabinet on semi- or fully-concealed hinges with a combination catch and lock.

E. On cabinets 48 inch (1200 mm) high and over, install a 3 point catch assembly latching at top, bottom and approximate middle.

F. Verify all panelboard locks are keyed alike.

G. Provide typed directory card filled-out to clearly indicate the load served.

H. Door hinge to be on the side opposite escape route if applicable.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer’s written instructions and in accordance with applicable codes, rules and regulations.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES – Not Used

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used.

3.09 SPARE PARTS – Not Used

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16220

ELECTRIC MOTORS

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with the providing electric motors, and other related items, as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Low voltage electric motors and accessories, furnished under other Sections, and which are a part of equipment assemblies shall be in conformance with the requirements specified in this Section, unless otherwise noted. This section includes performance, and descriptive type specifications.

D. Unless otherwise specified or approved, all electric motors furnished and installed by the Contractor shall conform to the requirements specified herein.

1. Motors connected to Variable Frequency Drives shall be inverter duty rated in accordance with the requirements of NEMA MG-1.

2. Motors rated 1 hp or greater shall be premium efficient type per NEMA MG-1.

E. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Descriptive literature and motor characteristics.

2. Drawings and descriptive data as follows:

a. Complete list of all motors to be furnished.

b. Outlines, dimensions, weights, and wiring diagrams.

c. Location of main and accessories boxes with size of conduit entrance.

d. Efficiency and power factor at 1/2, 3/4 and full load.

e. Bearing design data and grease requirements.

f. Nameplate data.

g. Shop test report.

h. Field acceptance test report.

i. Strip heaters KW and voltage ratings.

j. Power factor correction capacitors, where required.

k. Built in overload protection device.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. Ship motors assembled to driven equipment complete except where partial disassembly is required by transportation regulations or for protection of components.

D. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.

E. Deliver spare parts at same time as pertaining materials. Delivery to Owner after completion of work.

1.06 REFERENCES

A. Institute of Electrical and Electronics Engineers (IEEE).

1. 112: Test Procedures for Polyphase Induction Motors and Generators.

2. 1349: IEEE Guide for the Application of Electric Motors in Class 1, Division 2 Hazardous (Classified) Locations.

B. National Electric Manufacturer's Association (NEMA):

1. MG-1: Motors and Generators.

C. National Fire Protection Association (NFPA):

1. 70: National Electrical Code (NEC).

1.07 QUALITY ASSURANCE

A. Motors to comply with the latest reference standards listed below.

1. National Electrical Code (NEC).

2. Underwriters Laboratories, Inc. (UL).

3. National Electric Manufacturer's Association (NEMA)

   a. NEMA Standard MG-1 - Motors and Generators.

4. Anti-Friction Bearing Manufacturer's Association, Inc. (AFBMA).

5. American National Standard Institute (ANSI).

6. Institute of Electrical and Electronics Engineers (IEEE).

   a. IEEE Standard 112 - Test Procedures for Polyphase Induction Motors and Generators.

   b. IEEE 1349 - IEEE Guide for the Application of Electric Motors in Class 1, Division 2 Hazardous (Classified) Locations.

B. Routine tests shall be performed on representative motors, and shall include the information described on NEMA MG1-12.54 Report of Test Form for Routine Tests on Induction Motors. Efficiency shall be determined in accordance with IEEE Publication No. 112, Method B. Power factor shall be measured on representative motors.

PART 2 PRODUCTS

2.01 MOTOR MANUFACTURERS

A. General Electric Company.

B. Reliance Electric.

C. U.S. Motors.

2.02 ELECTRIC MOTOR RATINGS:

A. Voltage Ratings:

   1. Unless otherwise specified, motors with ratings of 1/2 to 350 hp (0.37 to 261kW) shall be rated 460-volt (nameplate rating), three-phase, 60-Hertz; motors of 1/3 hp (0.25 kW) or less to be rated 115-volt, single-phase, 60 Hertz.

B. The following specific motor requirements shall be in the equipment specifications:

   1. RPM.

   2. Motor enclosure type.

2.03 MOTOR DESIGN REQUIREMENTS

A. Unless otherwise specified or permitted all electric motors furnished and installed by the Contractor shall conform to the requirements hereinafter set forth.

B. Motors connected to variable frequency drives shall be inverter duty rated.

C. Every motor shall be of sufficient capacity to operate the driven equipment under all load and operating conditions without exceeding its rated nameplate current or power or its specified temperature limit at rated voltage. Each motor shall develop ample torque for its required service throughout its acceleration range at a voltage 10 percent below nameplate rating. Where indicated on the electrical drawings to be operated on a reduced voltage starter, the motor shall develop ample torque under the conditions imposed by the reduced voltage starting method.

D. The motor shall have sufficient capacity to operate the driven equipment as given in the equipment detail specifications. The motor shall not be required to deliver more than its rated nameplate horsepower, at unity (1.0) service factor, under any condition of mechanical or hydraulic loading.

E. Type of Motors

1. All motors shall be NEMA Design B or of a type having starting characteristics and ruggedness as may be necessary under the actual conditions of operation and, unless otherwise specified, shall be suitable for full-voltage starting.

F. Insulation

1. All motors shall have Class B or Class F insulation with temperature rise by resistance at full load rating of a Class B insulation in accordance with NEMA Standards for Motors and Generators, NEMA MG1, and based on a maximum ambient temperature of 40 degrees C unless otherwise specified.

2. Insulation systems shall be manufacturer's premium grade, resistant to attack by moisture, acids, alkalies and mechanical or thermal shock for 480 volt motors. Provide 80 degrees C, Class B rise or better by resistance at 100 percent load and provide a Class F insulation system, suitable for an ambient temperature motor operation of 0 to 40 degrees C at no more than 3,300 feet (1,000 m) above sea level for inverter duty motors. This temperature rise shall be met when motors are operated and controlled with the VFD(s). The motor insulation system shall have full capability to handle the common mode voltage conditions imposed by the VFD.

3. Motors for outdoor service shall have vacuum/pressure impregnated epoxy insulation for moisture resistance.

4. Insulation for inverter duty motor windings shall meet or exceed the Pulse Endurance Index for magnetic wire and shall not be injured when exposed to repeated pulse type waveforms, repetitive high voltage transients, switching frequency and rate of rise of the pulse. Class H varnish shall be used.

G. Enclosures

1. Motors shall have a steel or cast iron frame and a cast iron or stamped steel conduit box, as specified below. Conduit box shall be split from top to bottom and shall be capable of being rotated to four positions. Synthetic rubber-like gaskets shall be provided between the frame and the conduit box and between the conduit box and its cover. Motor leads shall be sealed with a non-wicking, non-hygroscopic insulating material. A frame mounted pad with drilled and tapped hole, not less than 1/4-inch (6 mm) diameter, shall be provided inside the conduit box for motor frame grounding.

a. Totally enclosed fan cooled: TEFC motors shall have a steel or cast iron frame, cast iron end brackets, cast iron conduit box, 1.15 service factor at 40 degrees C, tapped drain holes (corrosion resistant plugs for frames 286T and smaller and automatic breather/drain devices for frames 324T and larger) and upgraded insulation by additional dips and bakes to increase moisture resistance.

b. Totally enclosed non-ventilated: TENV motors shall include the same rating and accessories as specified for TEFC motors.

c. Explosion proof motors shall comply with all requirements of Class I, Division I, Group D, hazardous locations as defined by the NEC and with all other safety codes pertaining thereto.

H. Special Purpose Motors

1. Submersible motors shall be manufacturer's standard.

2. Inverter duty rated: Motors for operation on variable frequency drives shall meet current power quality levels published in NEMA MG1, Part 31. Enclosures shall be equal to those furnished for severe duty or explosion proof motors. Motor shaft and bearings shall be insulated. Internal service factor shall be 1.15 that of the nameplate. Ventilation system shall be designed for maximum heat transfer. Stator laminations shall be stagger-stacked and stamped from high grade electrical steel to minimize eddy-current losses and heat build-up caused by inverter induced harmonics. Rotors shall be configured to minimize skin-effect heating.

I. Auxiliary Devices

1. Three phase motors shall not be provided with starting capacitors.

2. Single-phase motors requiring switching devices and auxiliary starting resistors, capacitors, or reactors shall be furnished as combination units with such auxiliaries either incorporated within the motor housings or housed in suitable enclosures mounted upon the motor frames. Each combination unit shall be mounted upon a single base and to be provided with a single conduit box.

J. General Design of Motors

1. Motors shall comply with the latest NEMA Standards Publication No. MG1 for Motors and Generators, unless otherwise specified.

2. All polyphase non-explosion proof motors shall be designed for energy efficient operation and meet the requirements of MG1-12.53 a and b.

3. Motor windings shall be braced to withstand successfully the stresses resulting from the method of starting. The windings shall be treated thoroughly with acceptable insulating compound suitable for protection against moisture and slightly acid or alkaline conditions.

4. Bearings shall be of the self-lubricating type, designed to ensure proper alignment of rotor and shaft and to prevent leakage of lubricant.

a. Bearings for open motors shall be of the sleeve or ball type, as specified under the respective items of mechanical equipment.

b. Bearings for totally enclosed and explosionproof motors shall be of the ball type.

c. Bearing minimum L-10 fatigue life in hours at 100 percent load shall be 50,000.

d. Bearing grease shall be of the 120 degrees C thermal capability type.

5. Vertical motors shall be provided with thrust bearings adequate for all thrusts to which they can be subjected in operation.

6. Vertical motors of the open type shall be provided with drip hoods of acceptable shape and construction. When the drip hood is too heavy to be easily removed, provision to be made for access for testing.

7. All three phase motors shall be provided with a 1.15 service factor.

8. Three phase motors shall be of cast iron construction including frame and end brackets.

9. Totally enclosed motors shall be provided with automatic breather and drain.

10. Motor nameplates shall be stainless steel.

11. Motor Terminal Boxes and Leads

a. Motors shall be furnished with oversize conduit terminal boxes to provide for making and housing the connections, and with flexible leads of sufficient length to extend for a distance of not less than 4 inches beyond the face of the box. An acceptable type of solderless lug to be furnished. Totally enclosed and explosionproof motors to have cast-iron terminal boxes.

b. Leads for space heaters shall be brought out into an auxiliary, cast, conduit box on the motor side opposite to the main terminal box. Auxiliary box to have 1 inch (50 mm) threaded conduit openings and shall be so constructed that conduit entrance may be placed at top, bottom, or either side.

c. A grounding terminal shall be provided in the main terminal box and a bronze grounding bolt to be furnished at the conduit side of the motor frame.

K. Motor Efficiencies

1. Three phase motors rated 1 hp (0.75 kW) and larger shall be of the premium efficiency, “Design E”, type per Table 12.1 of NEMA MG1 Part 12. Motors shall have a NEMA Nominal Efficiency not less than the values referenced in NEMA MG1. Efficiency values shall be based on tests performed in accordance with IEEE Publication No. 112, Method B. Motors with horsepower or rpm’s not listed shall conform to comparable standards of construction and materials as those for listed motors.

L. Shop Painting

1. Unless otherwise specified, motors shall be given a shop application of paint filler or enamel sealer, a flat coat of undercoater for enamel, and two coats of enamel or, in lieu of this treatment, other corrosion-resistant treatment customary with the manufacturer.

M. Motor Data

1. The Contractor shall furnish five certified copies of characteristic curves of each motor furnished, except 115-volt motors. Curves shall be supplied as a part of the driven equipment submittal.

N. Motor Shop Tests

1. Motor shop tests shall be made in accordance with the IEEE Test Codes as specified in the NEMA MG1 Standards for Motors and Generators. NEMA report-of-test forms to be used in submitting test data.

2. Motor efficiency shall be determined by use of IEEE Standard 112 Test Method B, and by use of MGI-12.53 a and b.

3. For induction motors 5 hp, up to and including 100 hp, copies of routine tests reports of electrically duplicate motors shall be furnished.

4. For motors 3 hp or less, no test data need be furnished.

O. Spare Parts

1. Provide recommended spare parts list.

2.04 ELECTRICAL INTERFACE

A. All items of electrical equipment that are furnished with process, heating, ventilating, or other equipment shall conform to the requirements specified under the applicable electrical sections of the Division 16 specifications. Enclosures for electrical equipment such as switches, starters, etc., shall also conform to the requirements specified under the applicable electrical sections of the Division 16 specifications.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. After motor installation but before connection to power wiring, test motor winding insulation in accordance with the applicable Division 16 requirements.

D. After connection to power wiring, check for operating temperature, correct rotation, vibration, alignment and operating current drawn under load.

E. Submit all motor test results for review and record.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer’s written instructions and in accordance with applicable codes, rules and regulations.

B. Field Testing

1. Inspect and test in accordance with NETA ATS, except Section 4.

2. Perform inspections and tests listed in NETA ATS, Section 7.2.1.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES – Not Used

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used.

3.09 SPARE PARTS – Not Used

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16260

VARIABLE FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with providing simplex type Variable Frequency Drive (VFD) units and appurtenances including drive reactors, DC chokes, harmonic filters, enclosures, and certain auxiliary items, as indicated and as specified, to provide a complete operating system. as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Variable frequency drive units shall be furnished by the driven equipment manufacturer (pump, fan, etc) supplier. Installation of the units shall be the responsibility of the Contractor. All conduit and wire installations associated with each VFD shall be provided under DIVISION 16, ELECTRICAL.

D. VFD units shall be manufacturer's standard technology and in production for a minimum of ten (10) years.

E. Provide control system operation, input and control signals, status signals and devices in DIVISION 16, ELECTRICAL and and as shonw of the drawings.

F. Provide VFD output filter or reactor, when cable length between VFD and motor is greater than 100 feet (30 m), to insure motor terminals do not experience overvoltage condition as defined by NEMA Standard MG-1.

G. Each VFD unit shall exhibit less than 5 percent voltage total harmonic distortion and less than 3 percent voltage distortion on each harmonic at their immediate upstream distribution bus as verified by calculation and testing. Harmonic current distortion to be in accordance with Table 26 29 23-1. This bus shall be referred to as the point of common coupling (PCC).

H. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Complete list of equipment and materials, including manufacturer’s descriptive and technical literature, catalog cuts, and installation instructions for all major components.

2. Complete wiring and schematic diagrams for the equipment furnished. Each wiring diagram shall be legible and not reduced from the original design drafted format. Provide a list of equipment on each wiring diagram for which it is applicable.

3. Panel layout and front view drawings.

4. Time versus current curves for protection devices.

5. Data sheets for all devices provided as part of the assembly.

6. All other details required to demonstrate that system has been coordinated and will properly function as a unit.

7. Provide data to verify that drives can be used for motor lead lengths up to 100 feet (30 meters) without output filters. Include information from the VFD manufacturer or output filter or reactor manufacturer (if required) stating that the motor terminal voltage limitations as defined by NEMA Standard MG 1, Part 31 are met. For VFDs located more than a cable length of 100 feet (30 meters) from the motor load, provide drawings which include information demonstrating that an output filter or reactor is included within the VFD.

8. Provide enclosure drawings and details showing all dimensions and construction details.

9. Harmonic Analysis Report: Provide harmonic analysis report. Report to be accepted by Engineer prior to release of drives for fabrication.

10. Submit voltage THD frequency scan of each type of VFD supplied for use in field testing.

11. Submit information relative to location and expertise of local service office and personnel.

12. Submit a Statement of Compliance indicating conformance to the Seismic Requirements specified. Certificate shall be signed and sealed by a Professional Structural Engineer holding current registration in the state for work of this project.

13. For informational purposes only, provide installation and anchoring details to meet earthquake requirements as specified and indicated on structural drawings.

14. For informational purposes only, submit manufacturer’s printed installation instructions.

15. Spare Parts Data: Submit a list of spare parts for the equipment specified.

16. Operating and Maintenance Instruction Manuals:

    Operating instruction manuals outlining step-by-step procedures required for system startup and operation.

    Manufacturer's name, model number, service manual parts list.

    Brief description of equipment and basic operating features.

    Maintenance instruction manuals outlining maintenance procedures.

    Troubleshooting guide listing possible breakdown and repairs.

    Point-to-point connection wiring diagram for the system.

    Performance Test Reports: Upon completion of installed system, submit in booklet form all shop and field tests performed to prove compliance with specified performance criteria.

17. Submit a Pump, Motor and VFD Statement of Compliance Coordinate Certificate.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. Shipping:

1. Ship equipment and materials, except where partial disassembly is required by transportation regulations or for protection, complete with identification and quantity of items.

2. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.

3. Deliver spare parts after installation but as specified before start-up of drives. Deliver to Owner after completion of work.

D. Storage:

1. Inspect and inventory items upon delivery to site.

2. Store and safeguard equipment, material and spare parts.

3. If the equipment cannot be placed into service after its receipt, store in a closed building or structure, in a clean, dry and ventilated area free from temperature, dirt and moisture extremes. Acceptable storage temperatures are from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) with temporary heaters provided within enclosures to prevent condensation. Provide heavy plastic envelope directly over variable frequency drive to protect against dust, dirt, and moisture. Provide lifting angles outside of envelope.

1.06 REFERENCES

A. American Society for Testing and Materials International (ASTM):

1. D178: Standard Specification for Rubber Insulating Matting

B. National Electrical Manufacturers Association (NEMA):

1. ICS 2: Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 Volts.

2. AB 1: Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures.

3. KS 1: Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

4. MG 1: Motors and Generators.

C. National Fire Protection Association (NFPA):

1. 70: National Electrical Code (NEC).

D. Underwriter's Laboratories Inc. (UL):

1. 489: Molded-Case Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.

2. 508: Electrical Industrial Control Equipment.

3. 1066: Low Voltage AC and DC Power Circuit Breakers Used in Enclosures.

1.07 SEISMIC DESIGN REQUIREMENTS

A. Conform to the requirements indicated on the structural drawings and as specified in herein.

B. It shall be the responsibility of manufacturer and supplier along with the Electrical Contractor to conform to the seismic design requirements for this project and for the work of this specification section.

1.08 WARRANTY AND SERVICE

A. Guarantee components, parts, and assemblies supplied by manufacturer against defects in materials and workmanship for a period of 24 months after turning the equipment over to the Owner, and in this time period include onsite, parts and labor warranty. All labor to be performed by local factory trained service engineers.

B. Ensure that equipment manufacturer has local branch office staff with trained, full-time employees who are capable of performing testing, inspecting, repair, and maintenance services.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturer shall have at least five years commercial experience in the manufacture, operation and servicing of equipment of type, size, quality, performance, and reliability equal to that specified.

B. Variable Frequency Drive Units:

1. ABB Drives.

2. Eaton Corporation, Electric Drives Division.

3. Square D Company.

4. Siemens Inc.

5. Toshiba Industrial.

C. VFD Input Filters and Output Filters/Reactors:

1. Trans-Coil, Inc.

2. MTE Corporation.

3. Power Quality International.

2.02 HARMONIC ANALYSIS

A. Each VFD unit shall be designed such that there is less than 5 percent voltage total harmonic distortion at the PCC. Current distortion at the PCC will be in accordance with Table 26 29 23-1. For the purpose of the analysis, it will be assumed that the facility transformer feeding the electrical system is at a lightly (50 percent) loaded condition.

Table 26 29 2316260-1
Maximum Harmonic Current
Distortion In Percent Il

	Odd Harmonic					
Ratio	**5 to 9**	**11 to 15**	**17 to 21**	**23 to 33**	**35 +**	**TDD**
Less than 20	4.0	2.0	1.5	0.6	0.3	5.0
20 to 50	7.0	3.5	2.5	1.0	0.5	8.0
50 to 100	10.0	4.5	4.0	1.5	0.7	12.0
100 to 1000	12.0	5.5	5.0	2.0	1.0	15.0
1000 +	15.0	7.0	6.0	2.5	1.4	20.0

Notes:
1. Even harmonics are limited to 25 percent of odd harmonics.
2. DC offset distortions not allowed.
3. Ratio = Isc/IL where:
   Isc = Maximum short circuit current at PCC.
   IL = Maximum demand load current at PCC (fundamental frequency component)

B. For each VFD unit, provide a harmonic analysis study at the point of connection to the immediate upstream distribution bus (PCC), based on pre-submittal data.

C. Each VFD unit shall be designed such that there is less than 5 percent voltage total harmonic distortion and less than 3 percent voltage distortion on each harmonic at the PCC. Current distortion to be within the limits of Table 26 29 23-1. For the purpose of the analysis, it will be assumed that the electrical system is at a lightly loaded condition, 50 percent load. If the VFD loads exceed 50 percent system loading, assume system is loaded at VFD full load ratings.

1. The Contractor shall supply the following pre-submittal information to the largest VFD supplier to complete the harmonics study.

   a. Full load fundamental current for each variable frequency drive (VFD) unit.

   b. Harmonic currents on per unit basis of full load fundamental for each VFD unit.

   c. Available fault current information from the electric utility and upstream transformer data.

   d. Distribution transformer sizes and impedances, if any.

e. VFD input line reactor and/or isolation transformer sizes and impedances from the utility source to the VFD units.

f. Conductor information between transformer secondary or generator terminals to the distribution buses and VFDs.

g. Generator kW, impedance, subtransient reactance generator constants for the condition when the electrical system is powered from the generator.

2. The results of the harmonics study shall verify that the levels of total harmonic voltage at each point of common coupling are less than 5 percent and that the voltage distortion on each harmonic is less than 3 percent. In addition, harmonic currents at the PCC will be within the limits of Table 26 29 23-1. The study shall separately consider each VFD distribution bus as points of common connection (PCCs). The study shall specify additional equipment required (e.g., filters) at each harmonic where harmonic reduction is required to insure compliance.

D. The study shall consider the following conditions:

1. The electrical system shall be powered by the electric utility, case 1, or solely by local generation, case 2.

2. The study shall include an explanation of all assumptions, sources of data, methodologies and formulas used in the study and a summary of the study results.

3. The Contractor shall supply all equipment required as a result of the final accepted harmonics study to comply with the requirements of Paragraph 1.01 F.

2.03 PROVISIONS

A. Service Conditions:

1. Ambient Temperature Range: 0 degrees C to 40 degrees C.

2. Operational Humidity: Up to 90 percent non-condensing.

3. Environment: As indicated on enclosure schedule.

4. Altitude: Below 3,300 feet above sea level.

5. Input Power:

a. Nominal Voltage: 480 volts (plus 10 percent or minus 10 percent), 3-phase, 3 wire

b. Nominal Frequency: 60 Hertz (plus or minus 2 Hertz.)

c. Service provided from feeder breaker in panelboard.

B. Drive System: 0-500 HP Units

1. General:

a. Furnish solid state variable frequency, microprocessor type with Pulse Width Modulated (PWM) output wave form converter. The VFD shall employ a full wave rectifier to prevent input line notching, a DC bus choke, DC bus capacitors and Insulated Gate Bipolar Transistors (IGBT) as the output switching device to convert nominal 480 volts, 3 phase, 60 Hertz, 3 wire input power into adjustable-frequency 3 wire system at 0 to 480 volts, 3 phase, 0 to 60 Hertz output power. Provide output speed control of required motor under variable torque load or constant torque as required by the driven equipment.

b. Motor control circuits shall be wired in accordance with the requirements specified herein or indicated on the Drawings. Where not indicated, the control circuits shall be standard two-wire “start-stop” and the Contractor shall furnish wiring accordingly. Controls shall be designed to allow for automatic re-start when power is returned after a system outage, unless otherwise directed.

c. Variable frequency drive manufacturer shall be responsible for the successful application and operation of the entire drive and control system serving the motor and driven equipment. This includes the responsibility for obtaining all loads, torque, speed and performance requirements from the respective sources and integrating these into a variable frequency drive system that fulfills the requirements of this Specification.

d. The Contractor and variable frequency drive system manufacturer are cautioned regarding the review and compliance with the total Contract Documents. Typical examples are circuit breakers, motor circuit protectors, magnetic starters, relays, timers, control and instrumentation products, pilot devices including pushbuttons, selector switches and pilot lights, enclosures, conduit, disconnect switches, terminal boxes, and other equipment.

e. Provide on drive, a disconnecting device and fixed diode input rectifier (for a constant power factor).

f. The drive unit shall be of modular design to provide for ease and speed of maintenance.

2. For units rated greater than 50 Hp, provide VFD with the following type three phase PWM rectifier section: 18-pulse, or higher full wave diode bridge. Provide multiple secondary integral transformer within enclosure at input bridge to provide appropriate phase shift.

a. As a minimum, the transformer shall provide for the cancellation of the 5th, 7th, 17th, 19th, positive and negative sequence harmonic currents at the primary connection.

b. The transformer shall reduce voltage and current distortion on the primary side and voltage distortion on the secondary side.

c. The design shall be optimized for harmonic rich and high neutral current environment.

d. Harmonic cancellation shall be by electromagnetic means only, capacitors or electronics are not acceptable.

e. Provide a primary to secondary phase shift by use of multiple secondaries.

3. All components of the drive shall be designed and sized for the abnormal condition of continuous operation of the driven equipment specified herein at loads up to 15 percent above rated full load.

4. RMS harmonic output of the drive not to provide more than 5 percent increase in motor heating over similar operation of the motor with zero harmonics in the current.

5. The unit shall withstand drive output terminal line-to-line and line-to-ground short circuits without component failure during start-up and during operation. Drive to safely shutdown until short is cleared.

6. NEMA type cabinet for each drive unit, as indicated on drawings and enclosure schedule. NEMA 4 and NEMA 4X enclosures to be provided with stainless steel hand operated quick disconnect devices and interior cooling systems. Provide hinged acrylic door with gasketing on front of door for each access to keypad controls.

7. For inverter rated squirrel cage motors, per NEMA Standard MG-1, Part 31.40.4.2, the following limit values at the motor terminals are to be observed. For motors with base rating voltage less than or equal to 600 volts, the peak instantaneous voltage must be limited to 1600 volts or less, with a voltage rise time greater than or equal to 0.1 micro-seconds.

8. The VFD manufacturer shall guarantee that the required voltage limits will be met with the motor installed up to 100 cable feet (30 m) from the VFD drive unit. If the VFD manufacturer is not able to guarantee that the above voltage limits will be met, provide a drive output filter or reactor, appropriately rated, located within the VFD enclosure and near the VFD output terminals, which shall ensure that the limitations listed above are maintained. A device located at the motor terminals is not acceptable.

9. When controlling for non-inverter rated squirrel cage motors, provide output filters to limit peak voltage at the motor terminal to less than 1000 V, increase voltage rise time and reduce common mode current.

10. VFD shall be capable of full rated output when powered by incoming voltage with Total Harmonic Distortion (THD) in excess of 10 percent.

11. Furnish series choke and capacitors on dc bus to reduce ripple in rectifier output and to reduce harmonic distortion reflected into incoming power feeders.

12. Properly size enclosure to dissipate heat generated by VFD within limits of specified service conditions.

    a. Provide NEMA enclosure type as indicated on drawings.

    b. Provide integral fans or cooling systems as required by the application.

    c. Circuit breaker interlock to be able to be bypassed via lever on front door surface.

    d. NEMA 1 and 12 type enclosures to have keypad controls located on exterior of enclosure.

    e. Provide visual alarm indicator on cabinet door.

f. Fans shall be located to allow quick removal and replacement without disassembly of drive components.

2.04 PERFORMANCE CHARACTERISTICS

A. Output amps: 110 percent of rated, continuous.

B. Current limit: Range 0 to 130 percent for constant torque applications, 0 to 110 percent for variable torque applications, for 1 minute minimum.

C. Acceleration time to top speed, 1-300 seconds, minimum, adjustable.

D. Deceleration time from top speed, 1-300 seconds, minimum, adjustable.

E. Frequency stability: +/- 0.5 percent (at 25 degrees C, +10 degrees C) after reaching operating temperature.

F. Output voltage: Proportional to frequency with low speed boost.

G. Combined drive/and filtering efficiency, defined as motor shaft KW divided by VFD input KW, shall meet the following minimum requirements at the specified operating points:

1. 97 percent at 60 Hertz VFD output and 100 percent load.

2. 92 percent at 50 Hertz VFD output and 60 percent load.

H. VFD fundamental power factor shall be 0.98 or higher at all speeds and loads.

I. The VFD shall be capable of sustaining continued operation with a 30 percent dip in nominal line voltage. Output speed may decline only if current limit rating of the VFD is exceeded.

J. Losses to be utilized in drive system efficiency calculation shall include the input line reactor, phase shifting transformer and, harmonic trap filter with capacitors. Auxiliary controls such as internal VFD control boards and cooling fans shall be included in all loss calculations.

2.05 DRIVE PROTECTION

A. General:

1. Fault detection and trip circuits shall protect VFD and connected motor against line voltage transients, single-phase, power line overvoltage and undervoltage, output overvoltage and overcurrent, and VFD overtemperature.

a. The VFD shall employ three current limit circuits to provide trip free operation.

b. The slow current regulation limit circuit shall be adjustable to a minimum 125 percent of the VFD’s variable torque current rating.

c. The rapid current regulation limit shall be adjustable to a minimum 170 percent of the VFD’s variable torque current rating.

d. The current switch off limit shall be fixed at a minimum 225 percent of the VFD’s variable torque current rating.

2. Internal Protection: Minimum circuitry as follows:

   a. Current limiting, fast acting, semiconductor input fuses for protection of internal power semiconductors.

   b. Instantaneous output overcurrent trip maximum: 200 percent.

   c. DC bus and control circuit transformer fusing.

   d. Grounded control chassis.

   e. Under and over voltage trip, 3 phases.

   f. Motor overload protection, with solid state relays.

   g. Circuit breaker, with door interlocked handle. Provide means to allow entry into panel where required by authorized personnel. Circuit breaker to be rated 25,000 AIC minimum.

   h. Fault reset push button.

   i. Line to ground faults.

   j. Input metal oxide varistor and input line reactor for transient protection.

   k. VFD overtemperature.

3. Troubleshooting: Diagnostic aids to indicate cause of fault; used to assist in troubleshooting circuit problems. Isolated Form C contacts for remote indication of alarms to include the following:

   a. Over/under voltage indication.

   b. Overcurrent trip indication.

   c. DC bus charged indication.

   d. Fault detection indication.

   e. Recycle start indication (to indicate that the unit tried to pick up load for three previous tries and failed).

4. Provide power loss ride through capability which will allow the logic to maintain control due to load inertia without faulting.

5. Provide a programmable automatic restart function which will provide a minimum with time delays between restarts of 3 restarts following a fault condition other than a ground fault, short circuit, internal fault, or user programmable fault condition. Restart type to be programmable for time delay or coasting motor restart.

2.06 CONTROL INTERFACE

A. Provide variable frequency drive unit with appropriate power circuitry and auxiliary contacts for energizing and controlling the following devices associated with the motor, if required:

1. Space heaters

2. Solenoid valves

3. Remote indication of motor start and stop (isolated contacts)

B. Minimum Control Features

1. LOCAL/REMOTE selection of Start/Stop control.

2. LOCAL/REMOTE selection of Speed Control.

3. Accept a grounded, isolated, 4-20 mA input remote speed control signal from an external device.

4. Provide a 4-20 mA output signal proportional to VFD output frequency for remote speed indication.

C. Control Devices

1. Provide operating, monitoring or alarm indicating devices, door mounted, with minimum as follows:

a. Drive System Disconnect Operator.

b. System control selector switch (RUN/OFF/REMOTE) (When in RUN position drive will run). Control switch shall be oil-tight, 30 mm units.

c. System speed control selector switch (LOCAL/REMOTE) (When in LOCAL position, speed controlled by manual speed potentiometer). Control switch shall be oil tight, 30 mm units.

d. Manual keypad controls to set speed in manual mode.

e. Speed indicating meter in percent speed to indicate speed of the converter powered motor.

f. Run time meter, mechanical type, round, UL Certified, non-reset type, with register to indicate hours and tenths of hours up to 99,999.9 hours.

g. Alarm and status lights. Provide LED cluster type, heavy duty, 30 mm oil tight units.

2. Control circuits shall be isolated from power circuits.

a. Unit to accept a 4-20 mA DC speed control signal from an isolated, ungrounded transmitter with unit in remote mode and from local door-mounted micro-processor type keypad with unit in local mode.

b. The input 4-20 mA signal to be optically isolated from the drive run control circuit.

c. Furnish door-mounted switch on the enclosure for local/remote mode.

d. Keypad controls to have adjustable minimum speed setting of 10 to 80 percent of full speed and maximum speed setting of 50 to 100 percent of full speed. The total speed setting to follow a linear time ramp, adjustable from 1-300 seconds for acceleration and deceleration control.

2.07 SHOP TESTING

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

B. Provide a factory performance test for each variable frequency drive unit. The test to consist of simulating the expected load to be driven. The drive to operate the actual motor load through the expected speed ranges. Test length to be a minimum of two hours.

C. Provide a factory burn-in test for 24 hours minimum and a control and alarm test on each drive unit by simulating each control signal and each alarm function to verify proper and correct drive unit action.

D. Provide typical prototype factory test data for short circuit testing of each type of drive supplied. Data to verify that each drive can be started into a line-to-line fault and line-to-ground fault on the drive terminals. Each drive can be operating at full load and be subjected to a line-to-line fault and line-to-ground fault on the drive terminals. All phases (A, B & C) to be included in test data.

E. Provide certified documentation of all tests performed.

F. Provide above stated tests in addition to routine factory tests.

G. Owner to have option to witness all factory tests. Notify Owner two weeks before all tests.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. Erect, install, and start-up equipment.

D. The VFDs shall be installed as shown on the drawings, in accordance with the manufacturer's installation instructions, and accepted shop drawings.

E. Install VFDs to allow complete door swing required for component removal. This is specifically required where a VFD is set in the corner of a room.

F. Factory-trained service personnel, other than sales representatives, shall supervise field installation, inspect, make final adjustments and operational checks, make functional checks of spare parts, and prepare a final report for record purposes. Adjust control and instrument equipment until this equipment has been field tested.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer's written instructions and in accordance with applicable codes, rules and regulations.

B. Inspection

1. Examine VFD location for satisfactory preparation. Check conduits and raceway location for connection to units.

2. Visually inspect delivered unit(s) and accessories for conformance with specification and drawings.

3. Verify availability of appropriate pacing signal.

4. Maintain variable frequency drive in upright position at all times.

5. Protect variable frequency drive against damage. Store drive in clean, dry environment with temperature and humidity within range as specified by drive manufacturer. Energize space heaters during storage as recommended by manufacturer.

C. Field Testing

1. Perform testing checkout, and start-up for variable frequency drive equipment under technical direction of manufacturer's service engineer. Under no circumstances energize any portion of the drive system without authorization from manufacturer's technical representative.

2. Field Tests

a. Test each drive over the total speed range that it will be required to operate through for the load being driven for a minimum of two hours. Determine for each drive, motor, and load combination the following at minimum speed, maximum speed, and at 1/3 and 2/3 points between the minimum and maximum speeds:

(1) Input power (kW), voltage, current and RMS power factor on the line side of the drive isolation device.

(2) Output to the driven load in kilowatts.

(3) For each drive, measure the harmonic voltage distortion and harmonic current distortion for each harmonic at the main distribution bus for maximum and minimum load conditions.

(4) Measure the total harmonic voltage distortion and total harmonic current distortion at each PCC for maximum and minimum load conditions.

b. Test each drive by using the actual control signal for remote and local operation.

c. Test each drive's alarm functions.

d. Perform all tests in the presence of the Owner's representative.

e. Perform the above test in addition to the manufacturer's normal field tests.

f. Submit final test report with summary comparing field test data with harmonic analysis design calculated values for each drive.

g. Testing determined not in compliance with Contract documents shall be repeated by the Contractor at no additional cost to the Owner.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES

A. Services of Manufacturer, specifically trained on type of equipment specified and as follows:

1. Assist in location of devices, methods of mounting, field erection, etc. - 1/2 person-day.

2. Functional Completion Testing - 1 person-day.

3. Startup - 1 person-day.

4. Commissioning - 1 person-day.

B. Person-day is defined as one 8-hour day, excluding travel time. Person-day requirements listed exclusive of travel time.

3.07 MANUFACTURER'S TRAINING

A. Services of Manufacturer, specifically trained on type of equipment specified and as follows:

1. At the end of start-up service provide for a maximum of six members of the owners staff at the facility site to receive training from the startup/testing service Engineer - 1 person-day.

B. Service-inspections during first year of operation, for use at Owner's request, and exclusive of repair, malfunction or other trouble-shooting service calls - 1 person-day.

C. Person-day is defined as one 8-hour day, excluding travel time. Person-day requirements listed exclusive of travel time.

3.08 LUBRICATION REQUIREMENTS – Not Used.

3.09 SPARE PARTS

A. The following spare parts shall be provided:

1. One spare board or card, three diodes, for each horsepower size drive One set of Lower Bearings

2. Three spares for all expendable items such as pilot lamps, power fuses, and control fuses.

2. One spare keypad for every three VFD of the same model.

B. Spares will be color-coded or otherwise keyed to their original counterpart such that improper installation of spare cards is impossible.

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

B. Provide variable frequency drives in accordance with UL 508A, supplement SB, and Article 409 of the National Electrical Code (NEC). All VFD units shall be provided with a UL label.

C. Ensure that conduit size and wire quantity, size, and type are suitable for the equipment supplied. Coordinate all design information with the Electrical Contractor. Review the proper installation of each type of VFD unit with the equipment supplier prior to installation.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16320

DRY-TYPE TRANSFORMERS

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with providing dry-type tramnsformers, and other related items, as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Provide: (1) copper-wound, dry-type transformers that are “Energy Star” rated as indicated and specified; and (2) Provide transformer windings and enclosures rated for the installation location and in accordance with the requirements herein.

D. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Manufacturer's product data of the transformer. Information to include:

a. Outline drawings including dimensions.

b. Weight.

c. Ratings and tap configuration.

d. Core and coil material.

e. Insulation system description.

f. Loss data and efficiency.

g. Accessories.

h. Mounting requirements.

i. Nameplate data.

j. Testing data.

2. Certificate of Compliance indicating conformance to the Seismic Requirements specified. Certificate shall be signed and sealed by a Professional Structural Engineer holding current registration in the state for work of this project.

3. For informational purposes only, provide manufacturers printed installation instructions including anchoring details to meet earthquake requirements as specified and indicated on structural drawings.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

C. Deliver transformers individually wrapped for protection and mounted on shipping skids. Lift only with lugs provided. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.06 REFERENCES

A. American National Standards Institute (ANSI):

1. Z55.1: Gray Finishes for Industrial Apparatus and Equipment

B. American Society for Testing and Materials International (ASTM):

1. D635: Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.

C. National Electrical Manufacturers Association (NEMA):

1. ST 20: Dry-Type Transformers for General Applications (ANSI C89.2). – withdrawn

D. International Electrical Testing Association (NETA):

1. ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

E. National Fire Protection Association (NFPA):

1. 70: National Electrical Code (NEC).

F. Underwriters' Laboratories, Inc. (UL):

1. 506: Standard for Specialty Transformers.

1.07 SEISMIC DESIGN REQUIREMENTS

A. Conform to the requirements indicated on the structural drawings and as specified in Section 01900.

B. It shall be the responsibility of manufacturer and supplier along with the Electrical Contractor to conform to the seismic design requirements for this project and for the work of this specification section.

1.08 REQUIREMENTS OF REGULATORY AGENCIES:

A. Furnish transformers in accordance with NEMA ST 20 and UL 506.

B. Furnish transformers with UL listing mark.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Square D Company

B. Eaton-Cutler-Hammer Corp.

C. Siemens, Inc.

D. General Electric Company.

2.02 TRANSFORMERS

A. In NEMA 1 and NEMA 12 designated areas, furnish general purpose, ventilated, dry-type transformers in indoor-style enclosure. On single-phase transformers and three-phase transformers above 9 KVA, provide not less than two windings per phase.

1. Temperature rise at hottest spot shall conform to NEMA Standards, and shall not bake and peel off the enclosure paint after the transformer has been placed in service.

2. Ventilation openings shall prevent accidental access to live components.

3. Thoroughly clean and paint enclosure at the factory with manufacturer's prime coat and standard finish.

B. In NEMA 4 or NEMA 4X designated areas, provide transformers with encapsulated windings and stainless steel enclosures.

C. Auto transformers shall not be used in place of general purpose dry-type transformers.

D. Furnish at least two 2-1/2 percent full capacity taps above and below nominal in high voltage winding for transformers rated above 15 kVA. Two five percent taps below rated voltage for transformers rated 15 kVA and below.

E. Furnish transformers, single-phase or three-phase, as indicated. Furnish transformers with kVA ratings as indicated.

F. Furnish three-phase transformers, Delta-Wye, Delta-Delta or Wye-Wye connected as indicated, and conforming to latest NEMA standards. Scott Tee connected transformers are not acceptable above 9 kVA.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Furnish transformers with primary and secondary voltages and frequency, wye connected, as indicated for secondary windings, with neutral brought out for cable termination.

I. Furnish transformers designed for continuous operation at rated kVA with normal life expectancy as defined in NEMA ST 20.

J. For transformers rated 30 kVA or less, ensure that performance is obtained without exceeding 115 degrees C average temperature rise by resistance or 145 degrees C hot spot temperature rise in 40 degrees C maximum ambient and 30 degrees C average ambient. Do not allow maximum coil hot spot temperature to exceed 185 degrees C.

K. Furnish transformers with 220 degrees C insulation materials with proven reliability for 15 kVA transformers and above. Furnish 185 degrees C insulation on transformers below 15 kVA.

L. Furnish transformers made of flame retardant materials that will not support combustion as defined in ASTM D635.

M. Furnish core mounting frames and enclosures of welded and bolted construction with mechanical rigidity and strength to withstand shipping, erection and short circuit stresses.

1. Cores shall be grain oriented, non-aging, and silicon steel.

2. Coils shall be continuous windings without splices except for tapes.

3. Coil loss and core loss shall be minimum for efficient operation.

4. Primary and secondary tap connections shall be razed or pressure type.

5. Coil windings shall have end fillers or tie downs for maximum strength.

N. Transformers located in areas where fire protection system sprinklers are located shall be provided with NEMA 2 rated enclosure to protect transformer from water falling at an angle of 75 degrees from the vertical.

O. Furnish transformers designed to meet UL thermal overload test of 200 percent of rated current for one half hour.

P. Furnish transformers not to exceed the 65 degrees C rise established by UL as safe limit for maximum surface enclosure temperature.

Q. Furnish transformers with sound level not exceeding:

Average Sound Level in dB	
kVA	NEMA ST 20
0-09	40
10-50	45
51-150	50

R. Install transformers with sound levels greater than 50 dB on resilient vibration isolating mounts to prevent amplification of sound. Transformers rated 15 kVA and larger to be provided with rubber washer anti-vibration pads and molded neoprene assemblies to isolate noise from the transformer to the mounting surface.

2.03 SHOP TESTING

A. Submit results of audible-sound-levels tests in accordance with NEMA ST 20 of similar size transformer.

B. Production test each unit in accordance with NEMA ST 20.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. Install unit in compliance with the manufacturer’s printed instructions. All electrical installation Work shall be in accordance with UL Listing Requirements and National, State, and Local Electrical Codes.

D. Set transformer plumb and level. Install and guard transformers as specified by latest NEC and ANSI standards, and in accordance with manufacturer's printed instructions.

E. Furnish adequate space around transformer to dispose of transformer full load losses by ventilation without creating excessive ambient temperature. Verify working clearances as required by the NEC are met.

F. Unless indicated otherwise on drawings, wall mount with suitable supports, transformers rated 15 kVA and below. Floor mount transformers rated above 15 kVA unless otherwise indicated on the drawings. In addition, all transformers located in NEMA 4 or NEMA 4X designated areas shall be wall mounted on Type 316 stainless steel channel supporting systems with Type 316 stainless steel concrete inserts, minimum 7 feet-6 inches (2.3 m) AFF. Provide all required seismic restraints.

G. Provide lifting lugs and jacking plates on transformer enclosure.

H. Provide concrete pad for all floor mounted transformers.

I. Clean metal parts, excepting cores and core mounting frames, then rust-proof and apply heavy coating of inert primer. Paint coverplates and external metal parts with two finish coats of ANSI Z55.1 No. 61 or 49 Gray.

J. Verify mounting pads are in place to reduce noise.

K. Install grounding and bonding in accordance with the drawings and SECTION 16450, GROUNDING.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer's written instructions and in accordance with applicable codes, rules and regulations.

B. Field Testing

1. Inspect and test in accordance with NETA ATS, except Section 4.

2. Perform inspections and tests listed in NETA ATS, Section 7.2.1.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES – Not Used

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used.

3.09 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

3.10 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16400

SURGE PROTECTION DEVICES (SPDs)

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with providing Surge Protection Devices (SPD) integral to the electrical distribution system equipment, including distribution system and panel boards, and other related items, as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. The components shall provide protection for electrical and electronic devices against the damaging effects of surges, transients and electrical line noise.

D. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd edition listing by UL.

2. SPD type, model number, system voltage, phases, modes of protection, Maximum Continuous Operating Voltage (MCOV) Voltage Protection Rating (VPR), Short Circuit Current Rating (SCCR), and Nominal Discharge Current (In).

3. Outline drawings and internal wiring diagrams, including ratings of overcurrent circuit protection included with or provided for the unit.

4. Where separate Surge protection Devices are required by the Contract Drawings, provide manufacturer’s standard installation requirements.

5. Factory test data.

6. Operating and Maintenance Instruction Manuals:

(1) Operating instruction manuals outlining step-by-step procedures for system startup and operation.

(2) Manufacturer’s name, model number, service manual parts list.

(3) Brief description of equipment and basic operating features.

(4) Maintenance instruction manuals outlining maintenance procedures.

(5) Troubleshooting guide listing possible breakdown and repairs.

(6) Simplified connection wiring diagrams for each circuit.

7. Factory performance test for each unit. The tests shall be in accordance with the latest version of NEMA and Ul Standards.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 REFERENCES

A. Underwriters Laboratory (UL)

1. ANSI/UL 1449 Third Addition – Standard For Safety – Surge Suppression Devices.

2. UL 1283 – Standard For Safety – Electromagnetic Interference Filters.

B. National Electric Code and all applicable state and local codes.

C. American National Standard Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE):

1. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

2. ANSI/IEEE C62.45 - IEEE Recommended Practice on Surge Testing for Equipment Connected to Low Voltage (1000 V and less) AC Power Circuits.

3. National Electrical Manufacturers Association (NEMA):

4. NEMA 250 - Enclosures for Electrical Equipment (1000 volts maximum)

5. NEMA LS 1 - Low Voltage Surge Protection Devices

1.07 QUALITY ASSURANCE:

A. SPD units and all components shall be designed manufactured and tested in accordance with the latest applicable UL Standard (ANSI/UL 1449 3rd Edition).

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Surge Protection Devices.

1. Eaton-Cutler Hammer

2. General Electric

3. Siemens

2.02 GENERAL

A. Electrical Requirements

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.

2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 125 percent of the nominal system operating voltage.

3. Short Circuit Current Rating (SCCR) – The minimum SCCR of the SPD types 1 and 2 shall be 100 KA.

4. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

5. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

6. Nominal Discharge Current (I_n) – All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.

7. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

Modes	208Y/120
L-N; L-G; N-G	4600V
L-L	1000V
N-G	700V

8. ANSI/IEEE C High Let-Through Voltage – The let through voltage based on an ANSI/IEEE C62.41 Category C High waveform (10kV, 10kA) shall not exceed the following:

Mode	208Y/120
L-N	560V

9. ANSI/IEEE Cat. B Ringwave Let Through Voltage – The let-through voltage based on an ANSI/IEEE C62.41 Category B ringwave (6 kV, 500 amps) shall not exceed the following:

Mode	208Y/120
L-N	160V

B. SPD Design

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.

3. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.

4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.

5. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:

   a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.

      (1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.

      (2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.

(3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

b. Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.

c. Surge Counter – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

(1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection - The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

8. Safety Requirements

a. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

2.03 SYSTEM APPLICATION

A. The SPD applications covered under this section include Distribution Panel board assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
CATEGORY	Application	Per Phase	Per Mode
A	208/120 VAC Panel boards	120 kA	60 kA

C. SPD Type – all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect or separately derived system first overcurrent device shall be Type 1 or Type 2 SPDs. All SPDs installed in panel boards shall be Type 2.

D. Service entrance rated SPD units shall be compliant with UL requirement to receive a lightning protection Master Label Certificate of compliance for lightning protection system.

2.04 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

A. The SPD application covered under this section includes lighting and distribution panel boards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.

1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.

2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panel boards shall be installed immediately following the incoming main lugs.

3. The panel board shall be capable of re-energizing upon removal of the SPD.

4. The SPD shall be interfaced to the panelboard via a direct bus bar connection or a circuit breaker for disconnecting purposes as indicated on the Contract Drawings. The SPD shall be located directly adjacent to the disconnecting circuit breaker.

5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panel board.

6. The SPD shall be of the same manufacturer as the panel board.

7. The complete panel board including the SPD shall be UL67 listed.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. Install unit in compliance with the manufacturer's printed instructions. All electrical installation Work shall be in accordance with UL Listing Requirements and National, State, and Local Electrical Codes.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer's written instructions and in accordance with applicable codes, rules and regulations.

B. Provide checkout and testing in accordance with SECTION 16050, ELECTRICAL WORK – GENERAL and SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS and as specified herein.

C. Visually inspect delivered unit(s) and accessories for conformance with the Contract Drawings and specifications.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES – Not Used

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used.

3.09 SPARE PARTS – Not Used

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16402

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEM

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with providing a complete underground distribution system, and other related items, as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Conform to lines, grades, elevations, and dimensions. Resolve interferences with other underground conduit, piping or equipment, either new or existing. Match components suitable for proper installation.

D. Provide concrete encasement of duct system where indicated. Include forms and reinforcing steel in installation. Perform work in accordance with SECTION 16050, ELECTRICAL WORK – GENERAL.

E. Provide Schedule 40 polyvinylchloride (PVC) conduit for power and control circuits. Provide rigid galvanized steel conduits for instrumentation and communication circuits.

F. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. "Record" drawings.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 REFERENCES

A. National Fire Protection Association (NFPA):

1. 70: National Electrical Code (NEC).

PART 2 PRODUCTS

2.01 MANUFACTURER'S COMPLIANCE

A. Manufacturer's acceptance contingent upon products' compliance with specifications.

2.02 MANUFACTURERS

A. Polyvinylchloride (PVC) Conduit:

1. Specified in SECTION 16110, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

B. Rigid Steel Conduit, Galvanized:

1. Specified in SECTION 16110, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

2.03 MATERIALS AND COMPONENTS

A. Conduit Spacers: Furnish conduit spacers made of plastic to maintain spacing between conduits.

B. Concrete: Minimum compressive strength, 3,000 psi (20 MPa).

C. Hot-dipped galvanized steel conduit used underground to be painted with bituminous paint.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. Conduits

1. Provide minimum separation of power and control conduits of 3 inch (75 mm) both vertically and horizontally. Build ductbank layer by layer, backfill and compact each layer to provide support for next layer.

2. Separate power and control ducts from instrument ducts by a minimum of 12 inches (300 mm).

3. Backfill ductbank in layers and tamp or "puddle" as directed. Provide yellow ductbank marker tapes, reading "Caution - Electrical Lines Below", over entire length of ductline. Locate tapes 12 inches (300 mm) below grade. Provide a tape for every 12 inches (300 mm) of width of ductline.

4. Install conduit, indicated to be encased in concrete with spacers and reinforcing, as specified and as indicated. Rigid galvanized steel conduits to be painted with bituminous paint.

5. Install conduit runs following routing on drawing and running in straight lines. Where deviation from a straight line becomes necessary, install bends of radius which allow for rodding and installation of cable.

6. Accomplish changes in direction of runs exceeding total of 10 degrees, either vertical or horizontal, by long sweep bends having minimum radius of curvature of 25 feet (8 m) Manufactured bends can be used at ends of short runs of 100 feet (30 m) or less, and then only at or close to the end of run. Provide long sweep bends made up of one or more curved or straight sections and/or combinations thereof. Install manufactured bends with minimum radius of 36 inch (1,000 mm) where larger radius cannot be used.

7. Lay ductlines to minimum slope of 4 inch (100 mm) per 100 feet (30 m) and slope to handholes, as indicated. Ductlines are to slope away from buildings.

8. Install spacers at intervals of approximately 4 feet (1200 mm) and stagger between tiers of ducts to provide not less than 12 inches (300 mm) of longitudinal separation. Install base spacers to provide at least 3 inches (75 mm) between bottom of trench and underside of bottom conduits. Completely fill space with concrete. Firmly wire conduits and spacers together before concrete is placed.

9. Ductbanks are to be formed, unless trench conditions allow for neat placement of concrete with specified clearances.

10. Prior to placing of concrete, remove all dirt, sand, and any other debris from between conduits and from trench bottoms. Hold conduits in place to prevent floating or accidental movement.

11. Stagger joints in conduits at least 6 inches (150 mm). Do not allow couplings to rest on bottom of trench. Install couplings for plastic conduit in accordance with manufacturer's recommendations.

12. Install concrete encasements so minimum clearance of 12 inches (300 mm) from concrete to parallel pipes, lines, structures, etc., is maintained. Where ducts cross, minimum clearance of 6 inches (150 mm) is required. Do not allow the top of concrete to be less than 30 inches (750 mm) below finished grade or paving. Submit special conditions which may require lesser clearances or special conditions which may require greater than 30 inches (750 mm) depth for acceptance.

13. Do not use power-driven vibrators for spading of concrete around ducts.

14. Roll and grade backfill, and restore surface to condition equal to the site finish grade, or as otherwise indicated.

15. Locate ductbank markers at ends of all ductbanks except at handholes, at approximately every 200 feet (65 m) along duct run, and at each change in direction of duct run. Place markers approximately on ductbank. Install markers 6 inches (150 mm) square or round section by 3 feet (1 m) long made of Class B concrete. Imprint the letter "D" or cast it on top of the marker. Install top of duct markers flush in paved areas, protruding no more 2-inches above finished grade in unpaved areas. In finished lawns, allow marker to protrude 1/2-inch (12 mm).

16. Keep conduits clean of concrete, dirt, and other substances during the course of construction. After the ductlines have been completed, pull a standard flexible mandrel not less than 12 inches (300 mm) long, having a diameter approximately 1/4-inch (6 mm) less than the inside diameter of the conduit, through each conduit, after which pull a brush with stiff bristles through each conduit to make certain that no particles of earth, sand, or gravel have been left in the line. Replace conduit runs that do not allow the passage of the mandrel at no additional cost to the Owner. Pneumatic rodding may be used to draw in the lead wire. Install in spare conduits a pull wire or rope, and plug and seal spare conduits after cleaning.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer’s written instructions and in accordance with applicable codes, rules and regulations.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES – Not Used

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used

3.09 SPARE PARTS – Not Used

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

B. Record Drawaings of Underground Work

1. Furnish one set of marked copies of contract drawings, showing exact routing and depths of all underground conduit. Furnish scaled plot plans, showing principal outline of buildings and structures. Reference conduits, ducts, and all bends deviating from straight line, dimensionally from fixed objects or structures.

END OF SECTION

SECTION 16450

GROUNDING

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with the installation of grounding systems, and other related items, as specified herein and as shown on the drawings.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 REFERENCES

A. American National Standards Institute (ANSI)

1. ANSI C2: National Electrical Safety Code

B. National Fire Protection Association (NFPA)

1. NFPA 70: National Electric Code

2. NFPA 780: Lightning Protection Code

C. National Electrical Code and local codes.

D. American Society for Testing and Materials (ASTM)

1. B3: Soft or Annealed Copper Wire

2. B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

3. B33: Tinned Soft or Annealed Copper Wire for Electrical Purposes.

E. Underwriters Laboratories, Inc. (UL):

1. U.L. 44: Wires and Cables Rubber Insulated.

2. U.L. 83: Wires Thermoplastic-Insulated.

F. National Electrical Mfg's Association (NEMA):

1. WC 3: Rubber Insulated Wire & Cable.

2. WC 5: Thermoplastic Insulated Wire & Cable.

3. WC 7: Cross-Linked-Thermosetting Polyethylene-Insulated Wire & Cable.

4. WC 8: Ethylene-Propylene-Rubber-Insulated Wire & Cable.

1.07 SEISMIC REQUIREMENTS

A. Conform to the requirements as indicated on the Structural Drawing 00 S-001 and as specified in Section 01900.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Ground Rods:

1. Erico Products Inc.

2. Galvan Electrical Products.

3. Nehring Electrical Works.

4. Or equal.

B. Exothermic Welding:

1. Erico Products, Inc.

2. American Brass Mfg. Co.

3. Orgo-Thermit, Inc.

4. Or equal.

C. Connecting Hardware:

1. American Brass Mfg. Co.

2. Thomas and Betts

3. Anderson Electric Corp.

4. Or equal.

2.02 MATERIALS AND COMPONENTS

A. Conductors

1. Provide copper grounding conductors bare or insulated, sized as indicated or as required by the NEC. Provide protection of conductors if physical damage would result from direct exposure.

2. Provide bare tinned copper conductors where conductors are buried in the earth or where they are embedded in the concrete.

3. In buildings, provide insulated grounding conductors with green insulation. Provide insulated grounding conductors with insulation rated at 600 volts.

B. Ground Bus

1. Provide a 2-in. by 1/4-in. tinned copper bar with bolted type connectors as indicated.

C. Ground Rods

1. Provide copper-clad steel or galvanized steel ground rods; type, diameter and length as indicated on drawings. Make cable to ground rod connection without passing over end of ground rod.

D. Connections

1. Provide silicon bronze ground clamps for use on copper or brass pipes which are UL listed.

2. Provide ground clamps, for use on iron pipes, of galvanized or malleable iron, or of standard noncorrosive material.

3. Furnish ground clamps, for use on pipes, with rigid metal base providing solid contact by seating on the pipe. Do not use strap type clamps.

PART 3 - EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. Grounding Connectors

1. Install grounding conductors so that they will not be exposed to physical damage. Install connections firm and tight. Arrange conductors and connectors so no strain on connections.

2. Run grounding conductors associated with direct burial cables in common trenches above or if indicated beside cables.

3. Bury equipment grounding conductors 30 inches deep. Bring loops or taps up for connection to equipment or other items to be grounded.

4. Where raceways are used to contain and protect grounding conductors, install in accordance with SECTION 16110, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS and SECTION 16402, UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEM.

5. Where bare grounding conductors are contained within metallic raceways, bond ends of raceways to conductors.

6. Install loop type, low impedance, grounding system interconnecting all components so two grounding connections are provided for each item of electrical equipment. Ensure that severing of any single grounding conductor in this system does not remove grounding protection on any major item.

7. Connect structural steel at locations indicated to the grounding loop and connect to each vertical column by loop or tap. Provide exothermic weld connections. Connect two opposite points on external loop to two different points on grounding system.

8. Buried and concealed ground connections are to use exothermic welding.

9. Make accessible connections to structural members by exothermic welding process. Connections to equipment or ground bus shall be by bolted connectors.

D. Ground Rods

1. Install ground rods in manholes and handholes in accordance with requirements specified under SECTION 16402, UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEM. Connect each grounding conductor entering a manhole or handhole to ground rod by exothermic weld.

2. Install ground rods where indicated. Install the top of the rod 12-inches below the ground surface.

3. Make connection to overall grounding system as indicated.

E. Equipment Grounding

1. Ground each piece of electrical equipment by means of a grounding conductor installed in raceway feeding that piece of equipment with copper wire sized in accordance with National Electric Code. Grounding conductors installed in conduit with insulated conductors to be furnished with green, 600-volt insulation. Ground conductors are in addition to and not to be considered as the neutral wire of the system.

2. Connect power transformer cases and neutrals to grounding system. Connect neutral ground connection at transformer terminal. Provide two separate, independent, diagonally opposite, connections for power transformers so removal of one connection will not impair continuity of other.

3. Connect two separate ground connections from ground grid to ground bus of electrical cabinets and generator. Confirm that each connection for item of equipment is from different section of ground grid.

4. Connect a grounding conductor between panel board and grounding system. Where a grounding bar is furnished with panel board, connect grounding conductor to bar.

5. Where conduits are not effectively grounded by firm contact with a grounded enclosure, apply grounding bushings on one end of conduit run.

6. Connect grounding conductors from equipment in area where ground bus is required to ground bus. Connect ground bus to grounding system. Mount ground bus on 600V pedestal insulators.

7. Connect lightning arresters to ground system by suitable conductors. Where lightning arresters are furnished with electrical equipment and grounding connections are not inherently provided, confirm that separate grounding conductor connects lightning arresters with system ground.

8. Connect generator neutral to grounding system by a grounding conductor of size required by NEC, unless a larger size is indicated. Connect grounding conductor to generator disconnect enclosure and generator neutral on generator side of disconnect. Ground generator frame with two separate independent connections, so removal of one connection will not impair continuity of other.

9. Ground wire fences when used to enclose electrical equipment or when overhead electrical lines cross fence. Unless otherwise indicated, provide grounding by buried outside peripheral ground loop; connections to each corner fence post and nearby ground rod; flexible connections to each gate; and at least two connections to grounding system from approximately opposite positions on fence.

10. Connect the ground rods to the grounding conductor run with the direct burial cable.

F. Signal Gounding

1. Ground signal surge protection and shields of twisted, shielded cable using a signal bonding conductor. The signal bonding conductor shall be a continuous path from the instrument surge protection or shield to the grounding electrode conductor. The signal bonding conductor shall be isolated from the equipment grounding conductor for its entire path.

2. Where convenient several signal bonding conductors may be conbined, providing that all the following conditions are met:

3. The combined signal bonding conductor shall have the equivalent cross section of the conductors that it was combined from or three times the cross section of the largest conductor that it was combined from, whichever is less.

4. The combined signal bonding conductor shall be isolated from the equipment grounding conductor.

5. Where two signal bonding conductors are combined use a three port insulated splice.

6. Where three or more signal bonding conductors are combined, use a copper bus mounted on 600V insulators. Attach each conductor to the bus using an insulated ring tongue lug and screw terminal.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer’s written instructions and in accordance with applicable codes, rules and regulations.

B. Provide checkout and testing in accordance with SECTION 16050, ELECTRICAL WORK – GENERAL and SECTION 16998, FIELD INSPECTION AND ACCEPTANCE TESTS and as specified herein.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES – Not Used

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used.

3.09 SPARE PARTS – Not Used

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16900

ELECTRICAL CONTROLS AND MISCELLANEOUS ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with providing and connecting the electrical control equipment and miscellaneous electrical equipment, including such instruments and devices indicated and specified. Provide device enclosures for electrical equipment as indicated and specified.

B. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.

C. Control panel enclosures and devices specified herein are provided under those specification sections which invoke this section for control panel requirements or as indicated on electrical drawings.

D. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Wiring diagrams to show control interface points provided with other equipment.

1. Outline drawings with elevations.

2. Equipment arrangement drawings.

3. Anchor bolt location drawings.

4. Electrical schematics and wiring diagrams.

5. Electrical fuse/circuit breaker characteristic.

6. Equipment performance curves and data.

7. Bill of installation/assembly materials.

8. Equipment weights.

9. Completed manufacturer’s data sheets.

10. Sustainable design submittals.

1.05 PRODUCT HANDLING

A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.

B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.06 REFERENCES

A. American Society for Testing and Materials International (ASTM):

1. D178: Standard Specification for Rubber Insulating Matting

B. National Electrical Manufacturers Association (NEMA):

1. 250: Enclosures for Electrical Equipment (1000 volts maximum).

2. ICS 1: Industrial Control and Systems General Requirements

3. ICS 2: Industrial Controls and Systems Controllers, Contactors, and Overload Relays Rated 600 Volts.

4. ICS 4: Terminal Blocks for Industrial Use.

C. National Fire Protection Association (NFPA):

1. 70: National Electrical Code (NEC).

D. Underwriter's Laboratories, Inc. (UL):

1. 467: Standard for Grounding and Bonding Equipment.

2. 486A: UL Standard for Safety Wire Connectors and Soldering Lugs for Use with Copper Conductors.

3. 486B: UL Standard for Safety Wire Connectors for Use with Aluminum Conductors.

4. 489: Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.

5. 823: Standard for Safety Electric Heaters for Use in Hazardous (Classified) Locations.

PART 2 PRODUCTS

2.01 MANUFACTURERS FOR ELECTRICAL DISTRIBUTION EQUIPMENT

A. Siemens

B. General Electric Company

C. Eaton/Cutler-Hammer

D. Square D Company

E. Appleton Electric Company

F. Crouse-Hinds Company

G. O-Z/Gedney

2.02 SAFETY DISCONNECT SWITCHES

A. Provide heavy duty type, safety switches, with external operating handles, 3 PST, rated 600 volt, 60 Hertz with ampere rating as indicated, and having provisions for padlocking.

B. Provide fuses for safety switches as indicated.

C. Heavy duty safety switches to be UL listed, File E 2875 and 154828 (or equal), and meet or exceed NEMA Standard KS1.

2.03 CONDUIT AND WIRING

A. Provide conduit and wiring necessary to make connections between instrument panels, consoles, cabinets and external equipment and devices.

2.04 WALL MOUNTED CIRCUIT BREAKERS

A. Provide manually operated circuit breakers, ambient compensated, providing thermal magnetic inverse time limit overload and instantaneous short circuit protection. Provide overload protection on all poles; trip settings as indicated.

B. Provide circuit breakers with ratings as indicated on the Contract Drawings.

C. Provide time-current characteristic curves for each size of circuit breaker furnished.

D. Provide circuit breakers housed in NEMA type enclosure indicated, having external operating handles with provisions for padlocking.

E. Provide circuit breakers, with open/trip/close position auxiliary contacts where indicated – minimum of two contacts to indicate breaker trip.

2.05 CONTROL PANELS AND ELECTRICAL ENCLOSURES

A. Manufacturers:

1. McKinstry Incorporated.

2. Hoffman, Inc.

3. APX Enclosures.

4. Or equal.

B. Ensure that dimensions, NEMA rating, construction and mounting of equipment are as indicated.

C. Provide enclosure with back panels constructed of at least 14 gage (1.90 mm) steel and provided with terminal blocks for connection of external wiring. Provide door and body stiffeners in panels over 36 inches (915 mm) in length.

D. Provide UL listed and NEMA rated pushbuttons, indicator lights and switches of heavy duty, oil tight types. Provide relays of industrial types, with 120 volt, 60 Hertz operating coils, and contacts rated for intended service. Power from fused control power transformers.

E. Provide nameplates for each panel and each device on panel. Nameplates of laminated plastic material, at least 3/32-inch (2.4 mm) thick, and with white letters on a black background.

F. Secure nameplates with self tapping, Type 316 stainless steel metal screws.

G. Terminal Blocks:

1. Provide terminal blocks rated for 600 volts with screw type terminals.

2. Terminal blocks to be one piece with full barriers.

3. Provide General Electric EB-25 terminal blocks or equal.

H. Provide print pocket on inside of enclosure and include as-built drawings for Owner's use.

I. Where 480 volts AC and 120 volts AC are required within the same enclosure, install components to insure separation of wiring for the panel voltage circuits.

J. Enclosures and panels located outdoors shall be provided with heaters and thermostats. Enclosures 24 inch (610 mm) high and larger shall be provided with forced air heaters with thermostats as manufactured by Hoffman or approved equal. Thermostats shall be provided with a range of 40 degrees F (4 degrees C) to at least 60 degrees F (16 degrees C).

K. Enclosures 24 inch (610 mm) or larger shall be provided with light fixtures, light switch and 20 amp GFI protected receptacle.

L. Where equipment and devices are to be installed in hazardous locations, provide equipment and components suitable for the environment.

M. Where intrinsically safe wiring is required within the panels, the following requirements shall be met:

1. Within enclosures, conductors or intrinsically safe (IS) circuits shall be separated at least two inches (50 mm) from conductors of any non-intrinsically safe circuit. Within the enclosure the conductors shall be secured.

2. Intrinsically safe wiring shall not be routed in the same conduit as non-IS wiring.

3. Terminals in panels with IS wiring shall be identified in a manner that will prevent unintentional interference with the control circuits during testing and servicing.

N. All indicating lamps to be LED cluster type.

2.06 AUTOMATIC TRANSFER SWITCH

A. Furnish open transition, electrically operated automatic transfer switch of the current, voltage and short circuit current ratings indicated on the drawings, capable of switching all classes of load, and fully rated. Provide in conformance with Underwriters Laboratories, Inc., Standard 1008.

B. Acceptable manufacturers of transfer switches are Russelectric, Inc., Type RMT, Zenith, Automatic Switch Company, Type ASCO 7000, or equal.

C. Provide double throw transfer switch; interlocked molded case circuit breakers or contactors shall not be used.

D. Where indicated on the Contract Drawings, provide automatic transfer switches with integral normal and standby thermal magnetic circuit breakers.

E. Provide load contacts with silver surfaces, arcing tips and arc extinguishing devices. Furnish switch capable of closing on in-rush current values to 20 times its full load rating without contact damage and capable of withstanding the system fault clearing time of the overcurrent device. Operate transfer switch from the source to which the load is to be transferred, with time of transfer in either direction not exceeding one-half second. Positively interlock the normal and alternate contacts, both mechanically and electrically, to prevent them from being closed together at any time. Furnish main contacts mechanically held in position.

F. Provide the transfer switch with an interal manual operator that is safely operated from outside the enclosure with door closed. Provide the same contact-to-contact transfer speed as the electrical operator when manual operating handle is a permanently attached device to the operating mechanism.

G. Construct switch that will not allow switch to remain in a neutral position with both main and alternate contacts open if a coil fails or there is a disarrangement of any part.

H. On failure of a standby source, retransfer back to normal source without time delay if normal source available.

I. Provide transfer switch with solid state, microprocessor based controller with LCD front panel screen to provide the following:

1. Full-phase relay protection with three voltage sensing relays.

2. Starting and load transfer to alternate source on a drop to 80 percent on any phase of normal voltage or frequency. Retransfer of load to normal source when voltage of all phases is restored to 90-95 percent.

3. Nonadjustable time delay, 6 seconds, with 10 ampere, 30 VDC contact to close on failure of normal source.

4. Transfer to standby generator when generator voltage and frequency are 90 percent of rated values.

5. Adjustable time delay, 0 to 30 minutes, on transfer from alternate to normal.

6. Auxiliary and control contacts as follows:

a. One closed contact when switch is connected to the normal source for remote alarm.

b. Two sets of contacts. Each set will include two contacts to close when switch is connected to the normal source and two contacts to close when switch is on alternate source.

c. Two normally closed contacts to open on detection of loss of utility power for remote alarms.

d. One normally closed contact to open to indicate transfer switch trouble or fail condition for remote alarm.

J. After transfer to the normal source, engine generator to run for adjustable time period to 0 to 30 minutes before shutdown.

K. Test switch to test operation of standby generator and transfer switch.

L. Pilot lights to indicate presence of all three phases of normal source.

M. Pilot light to indicate switch position.

N. Terminal blocks for all external control and indication connections.

O. Furnish on the external side of the front door the following sign of laminated plastic material, 3/32-in. thick, with 1/2-in. high white letters on a red back ground.

P. Programmable exerciser to automatically exercise generator with or without load.

2.07 UTILITY METERING EQUIPMENT

A. Contractor to coordinate and provide all metering equipment in accordance with the electrical utility (NSTAR Electric) standards.

2.08 NAMEPLATES

A. Provide nameplates for equipment (including pushbutton and selector switch stations) listed in this section and other controls furnished under this contract, to designate the equipment controlled and their function.

B. Nameplates shall be laminated black bakelite with 1/4-inch (6 mm) high, white, recessed letters. Securely attach to the equipment with Type 316 stainless steel screws, or rivets. Adhesives, glue or cements will not be permitted.

C. Provide all junction boxes, pull boxes, disconnect switches and control panels with a nameplate to designate the system wiring contained within.

D. Install nameplates in a location near or on the equipment or devices.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

C. Wiring of Miscellaneous Devices

1. Make electrical connections required for recording and indicating instruments, and miscellaneous devices. Provide electrical supplies to metering, instrumentation, control, and alarm systems.

2. Connect HAND-OFF-AUTO switches, safety switches, tumbler switches, and other accessory devices as indicated or necessary for control of motors and other electrical equipment or devices.

3. Install conduit and wiring and make electrical connections between all instrument panels, consoles, cabinets, and external equipment and devices. Panels, cabinets, etc., are indicated.

D. Wiring of Equipment Furnished Under Other Sections

1. Install conduit, wiring, and connections for equipment and devices furnished under other Sections of specifications, and as indicated.

2. Unless otherwise indicated, control equipment, relays, control wiring, conduit, and connections for control of heating, ventilating, and air conditioning systems are provided as specified in SECTION 16050, ELECTRICAL WORK – GENERAL. Refer to mechanical specifications and drawings for locations of pressure-operated control switches, float switches, butterfly valves, solenoid operated valves, sump pumps, metering instruments, control panels, alarm actuating contacts, indicating lamps, limit switches, and other devices requiring wiring or interconnections with equipment supplied under DIVISION 16, ELECTRICAL.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer’s written instructions and in accordance with applicable codes, rules and regulations.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES – Not Used

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used

3.09 SPARE PARTS – Not Used

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION

SECTION 16998

FIELD INSPECTION AND ACCEPTANCE TESTS

PART 1 GENERAL

1.01 SCOPE

A. Provide field inspections and acceptance testing as specified herein.

B. After electrical installation is complete, perform tests to demonstrate that the entire system is in working order and in accordance with applicable codes, manufacturer's instructions, drawings and specifications. Test shall be performed per National Electrical Testing Association (NETA): Acceptance Testing Specification for Electrical Power Distribution System and Equipment (STD). Tests are in addition to, and not a substitution for, tests of individual items at the manufacturer's facilities. Perform insulation and ground resistance tests before operating tests. Determine proper rotation of motors before permanent connections are made.

C. Tests are also intended to accomplish the following:

1. Provide initial acceptance tests and recorded data.

2. Ensure a successful start-up with a minimum of last minute interruptions and problems.

3. Determine the suitability of the equipment and systems for energizing and placing into operating service.

4. Ensure that each system component is installed satisfactorily, will perform and will continue to reliably perform its function.

D. Provide all necessary supervision, labor, materials, tools, test instruments or other equipment or services and expenses required to test, adjust, set, calibrate, functionally and operationally check all work and components of the various electrical systems and circuitry throughout the installation.

E. Perform these tests after the electrical installation is complete. These tests shall demonstrate that the entire electrical system is in proper working order and in accordance with: applicable codes; and the supplier's instructions, drawings, and specifications.

F. Testing under this section in no way changes the requirements to perform the specified tests, checkouts, and inspections required under the equipment specification sections.

G. The listings and descriptions of the tests, and checks described herein is not to be considered as complete and all inclusive.

H. Retests required by defects and failures of equipment to meet specifications shall be conducted at no additional cost.

1. Replace wiring and equipment found to be defective, or failing to meet specified requirements, at no additional cost.

2. Supply electric current necessary for tests.

I. Where specified in other sections of DIVISION 16, ELECTRICAL, perform work under the supervision of factory trained technicians, representing the equipment being tested or inspected.

J. Attention is directed to the GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 DEFINITIONS

A. Definitions shall be as specified in GENERAL INFORMATION and DOCUMENT 00700, GENERAL CONDITIONS.

B. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the Project Site, complete with every necessary appurtenance and support.

2. "Install" shall mean unload at the delivery point at the Project Site and perform all Work necessary to establish proper location, secure mounting and operation in the Project.

3. "Provide" shall mean furnish and install.

4. “Work” shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, specialties, drains, hangers and supports, and all other accessories relative to such pipe or tubing.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, crawl spaces, embedded in construction, buried, and/or similar conditions.

7. "Exposed" shall mean not concealed as defined above.

8. “Furnished by others” shall mean materials or equipment purchased and set in place under other sections of the Contract and connected to the systems covered by this section of the Specifications by this trade Contractor.

9. "Coordinate" shall mean all Work provided under this section shall be correlated with the Work of other trades.

1.04 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted for all items to be furnished in accordance with the provisions of the DOCUMENT 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. Submit inspection and testing forms for all electrical distribution equipment to be inspected and tested under this section.

2. Submit data sheets for the insulation resistance testing of conductors and motors prior to performing operating testing. List all cables and motors to be tested.

3. Provide space on data sheet forms to enter the results of testing, instruments used with serial numbers, and name of personnel performing testing. This data to be filled out during testing.

1.05 PRODUCT HANDLING – Not Used.

1.06 REFERENCES

A. All inspections and tests shall be in accordance with the following applicable codes and standards latest revisions except as provided otherwise herein.

1. National Electrical Manufacturer’s Association – NEMA

2. American Society for Testing and Materials – ASTM

3. Institute of Electrical and Electronics Engineers – IEEE

4. International Electrical Testing Association – NETA – Acceptance Testing Specification for Electric Power Distribution Equipment and Systems (STD).

5. American National Standards Institute – ANSI:

a. ANSI C2: National Electrical Safety Code

b. ANSI Z244-1: American National Standard for Personnel Protection

6. State and Local Codes and Ordinances

7. Insulated Cable Engineers Association – ICEA

8. Association of Edison Illuminating Companies – AEIC

9. Occupational Safety and Health Administration:

   a. OSHA Part 1910; Subpart S, 1910.308

   b. OSHA Part 1926; Subpart V, 1926.950 through 1926.960

10. National Fire Protection Association – NFPA:

   a. ANSI/NFPA 70B: Electrical Equipment Maintenance

   b. NFPA 70E: Electrical Safety Requirements for Employer Workplaces

   c. ANSI/NFPA 70: National Electrical Code

   d. ANSI/NFPA 780: Lightning Protection Code

   e. ANSI/NFPA 101: Life Safety Code

B. All inspections and tests shall utilize the following references:

1. Project Design Specifications

2. Project Design Drawings

3. Manufacturer's instruction manuals applicable to each particular apparatus

1.07 SCHEDULING

A. The Contractor is responsible for the preparation of proposed procedures, testing and inspection forms, and schedules for all inspections, tests, settings and calibrations specified or otherwise required prior to or during the check out for start-up and acceptance of all the electrical components, equipment and systems. This work to be coordinated and to be compatible with the work of other crafts and the project schedule. The above must be organized and submitted with all proposed testing and NETA approved check out forms for the review. The procedures must provide specific instructions for the checking and testing of each component in addition to the system functional checks.

B. Prior to check out and testing for start-up, verify that all equipment and wiring is permanently identified with nameplates and tags. Check and tighten all terminals and connection points, remove all shipping blocks and hardware, thoroughly clean all equipment, repair all damaged or scratched finishes, inspect for broken and missing parts and review and collect manufacturer's drawings and instructions. Make routine checks and tests as the job progresses to verify that all wiring and equipment are properly installed.

C. Report all inspections, tests, and calibration in writing on NETA approved report forms. The recorded data from shall have the signatures of the persons conducting the tests and authorized witnesses. The forms shall serve as the test and inspection checklist for inspection requirements. Submit all test and check out data prior to adjustments, repairs, drying out, or similar work prior to final testing and acceptance. "As-found" and "as-left" test data to be recorded and reported in writing.

D. Sequence tests and checks such that the equipment can be energized immediately after the completion of the applicable tests.

PART 2 PRODUCTS

2.01 TESTING EQUIPMENT

A. Calibration

1. All calibration and setting checks shall be performed with the laboratory's calibrated test instruments. This test equipment to have calibrations traceable to the National Bureau of Standards. The dated calibration labels shall be visible on all test equipment. Calibrations over 6 months old will not be acceptable on field test instruments. All testing instruments shall be checked to verify satisfactory operation prior to proceeding with the tests. Serial and model numbers of the instruments used shall be recorded on the test forms.

2. Make necessary openings in circuits for testing instruments and place and connect all instruments, equipment, and devices, necessary for the tests. Upon completion of tests, remove instruments and instrument connections and restore all circuits to permanent condition.

2.02 TESTING

A. Coordination

1. Coordinate activities, and cooperate with others on project, to ensure that systems are energized when required, loads applied, and other requirements are carried out on timely, coordinated basis.

2. Conduct testing such that warranties or guarantees are not voided. Coordinate all testing with manufacturer's factory trained technicians, where applicable. Where specified tests are not compatible with the manufacturer's recommendations, obtain the manufacturer's review prior to testing. Permit witnessing by the manufacturer's representative if so requested.

B. Preparation

1. Make up no low voltage connections at service entrance, transformers, motors, switchboard and motor control centers, permanently until correct phase rotation of all equipment is determined. Install and insulate these connections temporarily, if necessary, while determining proper rotation. Make permanent connections after proper rotation has been established and subsequent to completion of insulation resistance and dielectric tests.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the Work of this Section, verify that the project is ready for this Work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

D. Notify subcontractors involved or affected by this Work and coordinate the Work with them.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

3.03 INSPECTION AND TESTING

A. Provide in accordance with manufacturer's written instructions and in accordance with applicable codes, rules and regulations.

B. Tests of Equipment, Cable and Circuits

1. List each circuit and measured resistance as test data.

2. Maintain records of all insulation resistance values. Identify conductor, or equipment, date that value was taken, and resistance value.

C. Specific Tests and Inspections

1. General - Perform tests and inspections as specified throughout DIVISION 16 - ELECTRICAL. Tests and inspections required by these sections are not necessarily repeated under this section.

2. Equipment Test and Inspection During Construction and Prior to Acceptance Testing:

a. Motors

(1) Visually inspect the motor for any physical damage.

(2) Before energizing any machine, visually inspect for serviceability. Verify that proper alignment has been performed. Check nameplate for electrical power requirements.

(3) Test run all motors before placing into regular service. A check on the motor for rotation, speed, current and temperature rise shall be made and results recorded. Maintain the proper color codes for phase identifications. A motor phase rotation meter should be used prior to connection at motor to prevent later swaps of phase wires.

b. Grounding Systems

(1) All major equipment grounds to be tested to remote earth. Visual inspection of all systems, raceway and equipment grounds to be made to determine the adequacy and integrity of the grounding. All ground testing results to be properly recorded, witnessed, and submitted.

(2) Ground tests shall be performed in accordance with NETA using a J. G. Biddle Company low resistance, Null balance type, ground testing ohmmeter, and test lead resistance compensated for. The test instrument to be the type, which compensates for potential and current rod resistances.

(3) Test entire grounding system for continuity of connections and for resistance. Ensure that ground resistance of conduits, equipment cases, and supporting frames does not vary appreciably from that of system as whole and does not exceed 3 Ohms.

c. Circuit Breakers – Low Voltage

(1) At the time of equipment receipt, visually check the exterior for any damage or defects.

(2) Perform complete inspection and electrical test in accordance with NETA.

d. Wire and Cable

(1) Before energizing, the continuity and insulation resistance of every circuit external to equipment shall be measured with a megger from each wire to all others and ground.

(2) Insulation resistance measurements shall be taken of the following:

(a) Motor Feeders: With motors disconnected, measure insulation resistance from load side of contactors or circuit breakers. Repeat this test after motors are connected and just before energizing at lower voltage as limited by the maximum test voltage for the motor.

(b) Motor Control Circuits (600 Volts): Measure insulation resistance from phase to ground only. Isolate any control elements that should not be meggered.

(c) Panel Feeders: Measure insulation resistance with circuit breakers, lighting transformers and panelboards connected, but with lighting branch circuit breakers or switches open.

(d) Branch Circuits: Measure insulation resistance after all lamp-holders, receptacles, fixtures, etc., are connected but before lamping.

(e) Feeder Circuits: Measure insulation resistance with connections to circuit breakers made up but with breakers open and loads not connected.

b. All cables and wires to be checked for proper identification numbering and/or color coding.

c. Perform inspection checks and electrical tests in accordance with NETA.

D. Conduit Systems

1. The conduit system to be checked for proper installation by using the following check list: (This list not to be considered all inclusive but as a guide for inspection).

a. Conduits are supported on appropriate independent supports (i.e., not on process piping, pipe ways, or piping hangers).

b. Exposed conduits are run in a neat workmanlike manner, parallel or perpendicular to structural members.

c. Conduits are routed as far away from possible fire hazards and heat sources as practical.

d. Conduits are supported at the required intervals.

e. Pull boxes and fittings are installed so that covers are easily removable. Verify that all covers are installed and tightly bolted with gaskets provided where needed.

f. Circular cross sectional area is uniform at conduit bends. Single bends do not exceed 90 degrees.

g. Conduits are terminated in threaded hubs or bushings to prevent damage to wire.

h. Conduits joints have joint compound of the type specified and are tight and conduit ends are properly reamed and threaded not to engage less than 5 threads.

i. Pull fittings are of adequate size such that cable can be installed and replaced at a later date without bending the cable less than code or manufacturer's requirements.

j. Seal fittings and/or sealing compound is installed at moisture barriers to prevent entry of moisture into equipment and/or where shown on plans.

k. Drains and conduit seals are installed on vertical conduit runs entering devices, equipment, and enclosures to prevent entrance of moisture.

l. Flexible conduit is installed at motors and other equipment as specified or required. Verify that all cabling and conduit runs are properly identified at each end.

2. Panel board electrical checks to be as included in the Wire and Cable section of this specification. Panelboards to be checked for proper circuit identification on the door schedule.

3. Sealing of Openings: Inspect the entire job to insure that all openings and holes provided or utilized are properly sealed as specified.

4. Where referenced NETA Standards indicate optional testing, perform these tests as described.

5. Loss Of Ac Power Test

   a. After the satisfactory completion of all electrical system testing, perform a loss of AC power test. The main circuit breaker at the facility shall be placed in the “OPEN” position by the Contractor using all required safety and personal protective equipment in accordance with NFPA 70E.

   b. During this test the representatives from the following organizations shall be present:

      (1) Contractor

      (2) Control System Supplier

      (3) Engine Generator System Supplier

      (4) Variable Frequency Drive Equipment Supplier

   c. The test shall verify that all electrical equipment in the system can withstand the loss of utility AC power. Under standby generator power, all automatically started equipment shall be witnessed to start and accept load without tripping offline or initiating false alarms.

   d. The test shall be performed with the facility operated at near or full load.

   e. All alarms associated with the loss of utility power and startup of the standby generator system shall be recorded.

      (1) Any nuisance type alarms associated with microprocessor faults or troubles shall be investigated and action taken to prevent reoccurrence.

      (2) When all nuisance type alarms have been resolved, the test shall be repeated to verify acceptable operation of the facility electrical system upon loss of utility power.

3.04 PAINTING

A. Shop painting and the surface preparation is a part of the Work specified in this section and shall be as specified in SECTION 09900, PAINTING.

3.05 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment and materials. Spillage of lubricants used in the installation and servicing the system components shall be cleaned from all equipment, materials, and surfaces.

3.06 MANUFACTURER'S FIELD SERVICES – Not Used

3.07 MANUFACTURER'S TRAINING – Not Used

3.08 LUBRICATION REQUIREMENTS – Not Used

3.09 SPARE PARTS – Not Used

3.10 QUALITY

A. Provide in accordance with SECTION 01400, QUALITY ASSURANCE.

3.11 CLOSEOUT ACTIVITIES

A. Provide in accordance with SECTION 01700, CONTRACT CLOSEOUT.

END OF SECTION