CITY OF NEWTON
PURCHASING DEPARTMENT

CONTRACT FOR PARKS & RECREATION DEPARTMENT

PROJECT MANUAL:

NEWTON HIGHLANDS PLAYGROUND REHABILITATION

INVITATION FOR BID #17-09

Pre-Bid Meeting: August 25, 2016 at 10:00 a.m.

Bid Opening Date: September 8, 2016 at 10:00 a.m.

AUGUST 2016

Setti D. Warren, Mayor

CITY OF NEWTON
PROJECT MANUAL TABLE OF CONTENTS
NEWTON HIGHLANDS PLAYGROUND REHABILITATION

		Page #
Cover Page		1
Table of Contents		2
1.	- Invitation for Bid	3-4
2.	- Instructions to Bidders	5-8
3.	- Bid Form	9-11
4.	- Bidder's Qualifications and References Form	12-13
	Certificate of Non-Collusion	14
	Debarment Letter	15
	IRS Form W-9	16
5.	- Contract Forms **(Informational only. Not required at time of bid submittal)**	18-19
	Certificate of Authority	20
	Certification of Tax Compliance	21
	Payment Bond	22
6.	- General Conditions of the Contract	23-28
7.	- Wages Rate Requirements	29
	Department of Labor Minimum Wage Rates	30-63
	Notice to Awarding Authorities	64
	Statement of Compliance	65
	Weekly Payroll Report Form	66
8.	- Contractors' Specifications	Separate File – 542 pages
9.	- Drawings (Drawings may be obtained through the Purchasing Department. Please call for availability.)	Separate File - 6 pages

END OF SECTION

CITY OF NEWTON

PURCHASING DEPARTMENT

INVITATION FOR BID #17-09

The City of Newton invites sealed bids in accordance with M.G.L. c.30, §39M from Contractors for:

NEWTON HIGHLANDS PLAYGROUND REHABILITATION

Pre-bid Meeting: **10:00 a.m., Thursday, August 25, 2016 located at Tennis Courts at the Newton Highlands Playground**

Bids will be received until: **10:00 a.m., Thursday, September 8, 2016**

at the Purchasing Department, Room 201, Newton City Hall, 1000 Commonwealth Avenue, Newton, MA 02459. Bids will not be accepted nor may submitted bids be corrected, modified or withdrawn after the deadline for bids. Immediately following the deadline for bids, all bids received within the time specified will be publicly opened and read aloud.

All bidders are encouraged to attend the pre-bid meeting. No allowance or adjustment to the contract price will be made on account of bidder's failure to become fully familiar with local conditions affecting the cost of work.

Work for this contract consists of site preparation, installation of new electrical, water and sewer connections to City systems, installation of athletic fields and athletic field drainage, installation of sports lighting, controls, and conduit, installation of new irrigation system, installation of a new playground with resilient rubber surfacing, new play equipment, re-installation of existing site furnishings, installation of tennis and basketball courts, new vinyl coated chain link fencing and gates, new seeded lawn and plantings, new parking lot and granite curbing, new site furnishings, bituminous concrete walks, new accessible walking trails, new concrete walks, and other improvements as fully described in the Technical Specifications.

Time is of the essence on this project. Work is expected to begin upon execution of this contract and must be substantially completed by November 15, 2017.

Contract Documents will be available for pickup at the Purchasing Department or by downloading them from www.newtonma.gov/bids , **after 10:00 a.m., August 18, 2016.** There is no charge for contract documents.

All bids must be accompanied by a bid deposit in an amount that is not less than five percent (5%) of the value of the bid, including all add alternates. Bid deposits, payable to the City of Newton, shall be either in the form of a bid bond, cash, certified check, or a treasurer's or cashier's check issued by, a responsible bank or trust company.

All bids shall be submitted as one ORIGINAL and two COPIES. Award shall be made to the lowest responsible and eligible bidder including all accepted alternates.

All bids are subject to the provisions of M.G.L. Chapter 30, Section 39M. **Wages are subject** to minimum wage rates determined by the Massachusetts Department of Labor and Industries pursuant to M.G.L. Chapter 149, Sec. 26 to 27H. The schedule of wage rates applicable to this contract is included in the bidding documents. In addtion, the prevailing wage schedule will be updated annually for all public construction projects lasting longer than one (1) year. You will be required to pay the rates set out in any updated prevailing wage schedule. Increases in prevailing wage schedules will not be the basis for change order requests. The successful bidder will be required to provide a Certificate of Insurance demonstrating current coverage of the type and amounts set forth in the Project Manual**.** The successful bidder will be required to furnish a **Labor and Materials Payment Bond in the amount of 50%** of the contract total.

It is the sole responsibility of the contractor downloading these bids to ensure it has received any and all **addenda** prior to the bid opening. If you dowload bids from the internet site and would like to make it known that your company has done so, you may fax or email purchasing@newtonma.gov the Purchasing Department. (617-796-1227) with your NAME, ADDRESS, PHONE, FAX **AND INVITATION FOR BID NUMBER. Drawings for this project may be obtained through the City of Newton's Purchasing Department.**

The City will reject any and all bids in accordance with the above referenced General Laws. In addition, the City reserves the right to waive minor informalities in any or all bids, or to reject any or all bids (in whole or in part) if it be in the public interest to do so.

In the event that any person wishes to attend a bid opening or pre-bid meeting, accessible and reasonable accommodations will be provided to persons requiring assistance. If you need a reasonable accommodation, please contact the city of Newton's ADA Coordinator, Jini Fairley, at least two business days in advance of the meeting: jfairley@newtonma.gov or (617) 796-1253. For Telecommunications Relay Service, please dial 711.

CITY OF NEWTON

Nicholas Read
Chief Procurement Officer
August 18, 2016

CITY OF NEWTON

DEPARTMENT OF PURCHASING

INSTRUCTIONS TO BIDDERS

ARTICLE 1 - BIDDER'S REPRESENTATION

1.1 Each General Bidder (hereinafter called the "Bidder") by making a bid (hereinafter called "bid") represents that:

1. The Bidder has read and understands the Bidding Documents, Contract Forms, General Conditions, Conditions of the Contract, General Requirements and Project Specifications (collectively, referred to as the "Contract Documents") and the bid is made in accordance therewith.

2. The Bidder has visited the work site and is familiar with the local conditions under which the work has to be performed.

1.2 Failure to so examine the Contract Documents and work site will not relieve any Bidder from any obligation under the bid as submitted.

ARTICLE 2 - REQUEST FOR INTERPRETATION

2.1 Bidders shall promptly notify the City of any ambiguity, inconsistency, or error which they may discover upon examination of the Contract Documents, the site, and local conditions.

2.2 Bidders requiring clarification or interpretation of the Contract Documents shall make a written request to the *Chief Procurement Officer*, at purchasing@newtonma.gov or via facsimile (617) 796-1227. The City will only answer such requests if received by **Friday, September 2, 2016 at 12:00 noon**. In the event that the bid opening date is changed, the deadline for informational requests may also change as provided in an addendum issued by the City.

2.3 Interpretation, correction, or change in the Contract Documents will be made by addendum which will become part of the Contract Documents. The City will not be held accountable for any oral communication.

2.4 Addenda will be emailed to every individual or firm on record as having taken a set of Contract Documents. Addenda will be emailed to every individual or firm on record as having taken a set of Contract Documents. Receipt of all addenda issued must be acknowledged in the Bid Form. YOUR FAILURE TO ACKNOWLEDGE ALL ADDENDA MAY RESULT IN YOUR BID BEING REJECTED AS NON-RESPONSIVE.

2.5 Copies of addenda will be made available for inspection at the location listed in the Invitation for Bids where Contract Documents are on file, in addition to being available online at **www.newtonma.gov/bids**.

2.6 Bidders or proposers contacting ANY CITY EMPLOYEE regarding an Invitation for Bid (IFB) or a Request for Proposal (RFP), outside of the Purchasing Department, once an IFB or RFP has been released, may be disqualified from the procurement process.

2.7 Bidders downloading information off the internet web site are solely responsible for obtaining any addenda prior to the bid opening. If the bidder makes itself known to the Purchasing Department, at purchasing@newtonma.gov or via facsimile (617) 796-1227, it shall be placed on the bidder's list. Bidders must provide the Purchasing Department with their company's name, street address, city, state, zip, phone, fax, email address and **INVITATION FOR BID #17-09**.

ARTICLE 3 - MBE PARTICIPATION

3.1 Notice is hereby given that the Mayor's Affirmative Action Plan for the City of Newton in effect at the time of this solicitation is applicable to all construction contracts in excess of $10,000.00.

3.2 Notice is hereby given that the City of Newton Minority/Women Business Enterprise Plan and the Supplemental Equal Employment Opportunity Anti-Discrimination and Affirmative Action Program in effect at the time of this solicitation are applicable to all City contracts for goods and services in excess of $50,000.00.

3.3 Copies of the Plans and Program referred to in Sections 3.1 and 3.2 are available at: **www.newtonma.gov/purchasing**.

ARTICLE 4 - PREPARATION AND SUBMISSION OF BIDS

4.1 Bids shall be submitted on the "Bid Form" as appropriate, furnished by the City.

4.2 All entries on the Bid Form shall be made by typewriter or in ink.

4.3 Where so indicated on the Bid Form, sums shall be expressed in both words and figures. Where there is a discrepancy between the bid sum expressed in words and the bid sum expressed in figures, the words shall control.

4.4 Bid Deposits shall be submitted in the amount specified in the Invitation for Bids. They shall be made payable to the City and shall be either in the form of cash, certified check, treasurer's or cashier's check issued by a responsible bank or trust company, or a bid bond issued by a surety licensed to do business in the Commonwealth of Massachusetts; and shall be conditioned upon the faithful performance by the principal of the agreements contained in the bid. Bidders are reminded that the bid deposit covers the City for damages when a bidder withdraws its bid after the bid submisssion date. **Be advised that to the extent permitted by the law the City will retain all bid deposits for withdrawn bids.**

Bid deposits of the three (3) lowest responsible and eligible Bidders shall be retained until the execution and delivery of the City-Contractor agreement.

4.5 The Bid, including the bid deposit shall be enclosed in a sealed envelope with the following plainly marked on the outside:

* GENERAL BID FOR: **#17-09**

* NAME OF PROJECT: **Newton Highlands Playground Rehabilitation**

* BIDDER'S NAME, BUSINESS ADDRESS, AND PHONE NUMBER

4.6 Date and time for receipt of bids is set forth in the Invitation for Bids.

4.7 Timely delivery of a bid at the location designated shall be the full responsibility of the Bidder. In the event that Newton City Hall is closed on the date or at the time that bids are due, the date and time for receipt of bids shall be on the next business day following that the Newton City Hall and the Purchasing Department are open.

4.8 Bids shall be submitted with one **original** and two **copies.**

4.9 Be advised that a new Massachusetts law has been enacted that required all employees who work on Massachusetts Public works construction sites must have no less than 10 hours of OSHA-approved safety and health training. See Chapter 306 of the Acts of 2004, which became effective July 1, 2006.

1. This requirement will apply to any general bid or sub bid submitted.
2. This law directs the Massachusetts Attorney General to restrain the award of construction contracts to any contractor who is in violation to this requirement and to restrain the performance of these contracts by non-complying contractors.
3. The contractor and all subcontractors on this project will be required to provide certification of compliance with this requirement. Non-compliance with this law will disqualify you from bidding on public contracts.

ARTICLE 5 - ALTERNATES

5.1 Each Bidder shall acknowledge alternates (if any) in Section C on the Bid Form.

5.2 In the event an alternate does not involve a change in the amount of the base bid, the Bidder shall so indicated by writing "No Change", or "N/C" or "0" in the space provided for that alternate.

5.3 Bidders shall enter on the Bid Form a single amount for each alternate which shall consist of the amount for work performed by the Contractor.

5.4 The low Bidder will be determined on the basis of the sum of the base bid and the accepted alternates.

ARTICLE 6 - WITHDRAWAL OF BIDS

6.1 Any bid may be withdrawn prior to the time designated for receipt of bids on written or electronic request. Electronic withdrawal of bids must be confirmed over the Bidder's signature by written notice postmarked on or before the date and time set for receipt of bids.

6.2 Withdrawn bids may be resubmitted up to the time designated for the receipt of bids.

6.3 No bids may be withdrawn within sixty (60) days, Saturdays, Sundays and legal holidays excluded, after the opening of the bids.

ARTICLE 7 - CONTRACT AWARD

7.1 The City is soliciting prices for items set forth in Bid Form #17-09, attached. It is the City's intent to award one (1) contract to the responsive and eligible bidder offering the lowest total price for the Base Bid and as many Alternates[1] as the City shall elect to award. Alternates can only be awarded in the same sequence as they appear in the Bid Form. A contract will be awarded within sixty (60) days, Saturdays, Sundays, and legal holidays excluded, after the opening of bids.

7.2 The City reserves the right to waive minor informalities in or to reject any or all Bids if it be in the public interest to do so.

7.3 The City reserves the right to reject any bidder who has failed to pay any local taxes, fees, assessments, betterments, or any other municipal charge, unless the bidder has a pending abatement application or has entered into a payment agreement with the collector-treasurer.

7.4 As used herein, 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 has met all the requirements of the invitation for bids; (3) 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; (4) who, where the provisions of section eight B of chapter twenty-nine apply, shall have been determined to be qualified thereunder.

7.5 Subsequent to the award and within five (5) days, Saturday, Sundays and legal holidays excluded, after the prescribed forms are presented for signature, the successful Bidder shall execute and deliver to the City a contract in the form included in the Contract Documents in such number of counterparts as the City may require.

7.6 In the event that the City receives low bids in identical amount from two or more responsive and responsible Bidders, the City shall select the successful Bidder by a blind selection process chosen by the City such as flipping a coin or drawing names from a hat. The low Bidders who are under consideration will be invited to attend and observe the selection process.

ARTICLE 8 - TAXES

8.1 The Bidder shall not include in this bid any tax imposed upon the sale or rental of tangible personal property in this Commonwealth, such as any and all building materials, supplies, services and equipment required to complete the work.

8.2 The City is exempt from payment of the Massachusetts Sales Tax, and the Bidder shall not include any sales tax on its bid. The City's exemption Number is E-046-001-404.

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[1] Alternates are options for which the bidders must submit separate prices that the awarding authority may choose to include in a bid package. The awarding authority reserves the right to select or reject the optional work, based on the prices received. Alternates are permitted only if they are ranked numerically in order of priority. When evaluating the bids, the City may select a specific alternate only after all of the higher ranking alternates have been selected. M.G.L. c. 149, § 44G(B).

ARTICLE 9 – PROPRIETARY SPECIFICATIONS

9.1 The City has used a proprietary specification to describe the supply listed in the specifications. Such specifications are permitted under M.G.L. c. 30, §39M(b), provided that the City states in writing that use of the proprietary specification is in its best interest and that it will accept an "equal" of the item specified. An item is considered equal if (i) it is at least equal in quality, durability, appearance, strength, and design; (ii) will perform the intended function at least equally; and (iii) conforms substantially, even with deviations, to the detailed requirements contained in the specifications. In the event that the Bidder wishes to substitute an equal item, it may do so either in its bid or proposal or after the contract is awarded but before a contract is executed, it being understood that the award shall be conditioned on the Bidder providing the item originally specified or an equal item accepted by the City and identified in the contract. In no event shall the Bidder be entitled to offer, or the City obliged to consider, the substitution of an item as equal after execution of a contract. In the event the Bidder substitutes or attempts to substitute an "equal" item after that date, it shall be in breach thereof and be liable for actual and consequential damages resulting from its failure to perform as agreed. The City shall have the sole right to determine whether or not said item is equal.

9.2 The required determination and justification have been duly prepared, and a copy may be requested in accordance with the Massachusetts Public Records Law, M.G.L. c. 66, §10.

ARTICLE 10 – ENVIRONMENTALLY PREFERABLE PRODUCTS

10.1 The City encourages environmentally preferable products, i.e., products or services that have less negative or more positive effects on human health and the environment when compared with competing products or services that serve the same purpose. The city encourages bidders to describe, in the space provided on the Bid Form, the environmental attributes of its goods or services throughout the entire life-cycle, including manufacture, use and disposition. This information may include multiple environmental considerations such as natural resource use, recycled content, energy and water efficiency, greenhouse gas emissions, impact on climate change, packaging, hazardous material use, and health and safety impacts on workers, consumers and the community. If you do not currently assess such attributes, please indicate that. However you respond, the City will not take your information into account in evaluating bid proposals.

10.2 Bidders are encouraged also to provide information related to steps they take internally to (a) identify any positive or negative environmental attributes of products or services they offer, as specified above, and (b) insure that those attributes are being addressed as part of operations.

END OF SECTION

CITY OF NEWTON

DEPARTMENT OF PURCHASING

BID FORM #17-09

A. The undersigned proposes to furnish all labor and materials required in accordance with the Contract Documents supplied by the City of Newton entitled:

NEWTON HIGHLANDS PLAYGROUND REHABILITATION

for the contract price specified below, subject to additions and deduction according to the terms of the specifications.

B. This bid includes addenda number(s) _____, _____, _____, _____,

C. The proposed contract price is as follows per the attached Price Schedules:

1. BASE BID

_____DOLLARS ($ _____).
(The figure inserted above shall be the Base Bid amount.)

2. ALTERNATES.

ALTERNATE 1 (Sod in lieu of athletic field seed mix.) **$_____**

ALTERNATE 2 (Sports field lighting control cabinet and sports field lighting and wiring at baseball field.) **$_____**

ALTERNATE 3 (Sports field lighting and wiring at football field.) **$_____**

ALTERNATE 4 (Concrete unit pavers in lieu of concrete paving.) **$_____**

COMPANY: _____

D. Prompt Payment Discounts. Bidders are encouraged to offer discounts in exchange for an expedited payment. Payments may be issued earlier than the general goal of within 30 days of receipt of the invoice only when in exchange for discounted prices. Discounts will not be considered in determining the lowest responsible bidder.

Prompt Payment Discount _____%_____Days
Prompt Payment Discount_____%_____ Days
Prompt Payment Discount _____%_____Days

E. The undersigned has completed and submits herewith the following documents:

- Bid Form - signed, 2 pages
- Bid Item Sheets, 3 pages
- Bidder's Qualifications and References Form, 2 pages
- Certificate of Non-Collusion, 1 page
- Debarment Letter, 1 page
- IRS Form W-9, 1 page
- A five percent (5%) bid deposit/bid guarantee.

F. The undersigned agrees that, if selected as general contractor, s/he will within five days, Saturdays, Sundays and legal holidays excluded, after presentation thereof by the City of Newton, execute a contract in accordance with the terms of this bid and furnish a labor and materials or payment bond of a surety company qualified to do business under the laws of the commonwealth and satisfactory to the City of Newton and each in the sum not less than 50% of the contract price, the premiums for which are to be paid by the general contractor and are included in the contract price.

The undersigned 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 they will comply fully with all laws and regulations applicable to awards made subject to M.G.L. Chapter 30, Section 39M. The undersigned certifies 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 ("OSHA") 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 OSHA that is at least 10 hours in duration. The undersigned understands that 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.

The undersigned further certifies that s/he intends to comply with the City of Newton Minority/Women Business Enterprise Plan dated December 1999 to further expand business opportunities for minority firms, and that s/he shall comply with the minority manpower ratio and specific action steps contained in the City of Newton, Massachusetts Supplemental Equal Employment Opportunity Anti-Discrimination and Affirmative Action Program.

The undersigned further certifies under the 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. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from public contracting or subcontracting in the Commonwealth under the provisions of M.G.L. Chapter 29, Section 29F or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

G. Environmentally preferable products information (which is requested but which will not be considered in awarding a contract):

Description of environmental attributes of Bidder's goods or services:

Steps taken to (a) identify any positive or negative environmental attributes of products or services and (b) insure that those attributes are being addressed as part of operations:

Date _____

_____
(Name of General Bidder)

BY: _____

_____
(Printed Name and Title of Signatory)

_____
(Business Address)

_____
(City, State, Zip)

_____/_____
(Telephone) (FAX)

_____
(E-mail address)

NOTE: If the bidder is a corporation, indicate state of incorporation under signature, and affix corporate seal; if a partnership, give full names and residential addresses of all partners; if an individual, give residential address if different from business address; and, if operating as a d/b/a give full legal identity. Attach additional pages as necessary.

END OF SECTION

CITY OF NEWTON

BIDDER'S QUALIFICATIONS AND REFERENCES FORM

All questions must be answered, and the data given must be clear and comprehensive. Please type or print legibly. If necessary, add additional sheet for starred items. This information will be utilized by the City for purposes of determining bidder responsiveness and responsibility with regard to the requirements and specifications of the Contract.

1. FIRM NAME: _____

2. WHEN ORGANIZED: _____

3 INCORPORATED? _____ YES _____ NO DATE AND STATE OF INCORPORATION: _____

4. IS YOUR BUSINESS A **MBE**? _____YES _____NO **WBE**? _____YES _____NO or **MWBE**? _____YES _____NO

* 5. LIST ALL CONTRACTS CURRENTLY ON HAND, SHOWING CONTRACT AMOUNT AND ANTICIPATED DATE OFCOMPLETION:

_____
_____
_____
_____
_____

* 6. HAVE YOU EVER FAILED TO COMPLETE A CONTRACT AWARDED TO YOU?
_____ YES _____ NO
IF YES, WHERE AND WHY?

_____
_____

* 7. HAVE YOU EVER DEFAULTED ON A CONTRACT? _____ YES _____ NO
IF YES, PROVIDE DETAILS.

_____
_____

* 8. LIST YOUR VEHICLES/EQUIPMENT AVAILABLE FOR THIS CONTRACT:

_____
_____
_____
_____
_____
_____
_____

* 9. IN THE SPACES FOLLOWING, PROVIDE INFORMATION REGARDING CONTRACTS COMPLETED BY YOUR FIRM SIMILAR IN NATURE TO THE PROJECT BEING BID. A MINIMUM OF FOUR (4) CONTRACTS SHALL BE LISTED. PUBLICLY BID CONTRACTS ARE PREFERRED, BUT NOT MANDATORY.

PROJECT NAME: _____
OWNER: _____
CITY/STATE: _____

DOLLAR AMOUNT: $ _____ DATE COMPLETED: _____
PUBLICLY BID? _____YES _____ NO
TYPE OF WORK?: _____
CONTACT PERSON: _____ TELEPHONE #: ____)_____
CONTACT PERSON'S RELATION TO PROJECT?: _____
(i.e., contract manager, purchasing agent, etc.)

_____

PROJECT NAME: _____
OWNER: _____
CITY/STATE: _____
DOLLAR AMOUNT: $ _____ DATE COMPLETED: _____
PUBLICLY BID? _____YES _____ NO
TYPE OF WORK?: _____
CONTACT PERSON: _____ TELEPHONE #: (____)_____
CONTACT PERSON'S RELATION TO PROJECT?: _____
(i.e., contract manager, purchasing agent, etc.)

_____

PROJECT NAME: _____
OWNER: _____
CITY/STATE: _____
DOLLAR AMOUNT: $ _____ DATE COMPLETED: _____
PUBLICLY BID? _____YES _____ NO
TYPE OF WORK?: _____
CONTACT PERSON:_____ TELEPHONE #: (____)_____
CONTACT PERSON'S RELATION TO PROJECT?:_____
(i.e., contract manager, purchasing agent, etc.)

_____

PROJECT NAME: _____
OWNER: _____
CITY/STATE: _____
DOLLAR AMOUNT: $ _____ DATE COMPLETED: _____
PUBLICLY BID? _____YES _____ NO
TYPE OF WORK?: _____
CONTACT PERSON: _____ TELEPHONE #:(____)_____
CONTACT PERSON'S RELATION TO PROJECT?: _____
(i.e., contract manager, purchasing agent, etc.)

10. The undersigned certifies that the information contained herein is complete and accurate and hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the City in verification of the recitals comprising this statement of Bidder's qualifications and experience.

DATE: _____ BIDDER: _____

SIGNATURE: _____

PRINTED NAME: _____ TITLE: _____

END OF SECTION

CERTIFICATE OF NON-COLLUSION

The undersigned certifies under penalties of perjury that this bid or proposal has been made and submitted in good faith and submitted in good faith and without collusion or fraud with any other person. As used in this certification, the word "person" shall mean any natural person, business, partnership, corporation, union, committee club, or other organization, entity, or group or individuals.

_____
(Signature of individual)

_____
Name of Business

City of Newton

Purchasing Department

Nicholas Read ✆ *Chief Procurement Officer*

1000 Commonwealth Avenue
Newton Centre, MA 02459-1449
purchasing@newtonma.gov

Telephone
(617) 796-1220
Fax:
(617) 796-1227
TDD/TTY
(617) 796-1089

Mayor
Setti D. Warren

Date

Vendor

Re: Debarment Letter for Invitation For Bid #17-09

As a potential vendor on the above contract, the City requires that you provide a debarment/suspension certification indicating that you are in compliance with the below Federal Executive Order. Certification can be done by completing and signing this form.

Debarment:

Federal Executive Order (E.O.) 12549 "Debarment and Suspension" requires that all contractors receiving individual awards, using federal funds, and all sub-recipients certify that the organization and its principals are not debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency from doing business with the Federal Government.

I hereby certify under pains and penalties of perjury that neither I nor any principal(s) of the Company identified below is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency.

_____ (Name)
_____ (Company)
_____ (Address)
_____ (Address)
PHONE _____ FAX _____
EMAIL _____

_____Signature

_____Date

.

If you have questions, please contact Nicholas Read, Chief Procurement Officer at (617) 796-1220.

Form **W-9**
(Rev. October 2007)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

Give form to the requester. Do not send to the IRS.

Print or type
See Specific Instructions on page 2.

Name (as shown on your income tax return)

Business name, if different from above

Check appropriate box: ☐ Individual/Sole proprietor ☐ Corporation ☐ Partnership
☐ Limited liability company. Enter the tax classification (D=disregarded entity, C=corporation, P=partnership) ▶
☐ Other (see instructions) ▶

X Exempt payee

Address (number, street, and apt. or suite no.)

Requester's name and address (optional)

City, state, and ZIP code

List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on Line 1 to avoid backup withholding. For individuals, this is your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN* on page 3.

Note. If the account is in more than one name, see the chart on page 4 for guidelines on whose number to enter.

Social security number

or

Employer identification number

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and
3. I am a U.S. citizen or other U.S. person (defined below).

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the Certification, but you must provide your correct TIN. See the instructions on page 4.

Sign Here **Signature of U.S. person ▶** **Date ▶** Name

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Purpose of Form

A person who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) to report, for example, income paid to you, real estate transactions, mortgage interest you paid, acquisition or abandonment of secured property, cancellation of debt, or contributions you made to an IRA.

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN to the person requesting it (the requester) and, when applicable, to:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),

2. Certify that you are not subject to backup withholding, or

3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income.

Note. If a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien,
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States,
- An estate (other than a foreign estate), or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax on any foreign partners' share of income from such business. Further, in certain cases where a Form W-9 has not been received, a partnership is required to presume that a partner is a foreign person, and pay the withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid withholding on your share of partnership income.

The person who gives Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States is in the following cases:

- The U.S. owner of a disregarded entity and not the entity,

Cat. No. 10231X Form **W-9** (Rev. 10-2007)

CONTRACT FORMS

The awarded bidder will be required to complete and submit documents substantially similar in form to the following.

These forms may need to be modified on account of changed circumstances, and are provided for informational purposes only.

CITY-CONTRACTOR AGREEMENT

CONTRACT NO. #17-09

THIS AGREEMENT made this _____ day of _____ in the year Two Thousand and Sixteen by and between the CITY OF NEWTON, a municipal corporation organized and existing under the laws of the Commonwealth of Massachusetts, hereinafter referred to as the CITY, acting through its Chief Procurement Officer, but without personal liability to him,

and _____ hereinafter referred to as the

CONTRACTOR.

The parties hereto for the consideration hereinafter set forth agree as follows:

ARTICLE 1. **STATEMENT OF WORK.** The Contractor shall furnish all labor, materials, and equipment and perform all work required in strict accordance with the Contract Documents for the following project:

NEWTON HIGHLANDS PLAYGROUND REHABILITATION

ARTICLE 2. **TIME OF COMPLETION. Time is of the essense on this project. Work is expected to begin upon execution of this contract and shall be substantially completed by November 15, 2017.**

ARTICLE 3. **THE CONTRACT PRICE.** The City shall pay the Contractor for the full and satisfactory performance of the Contract, in current funds the sum of:

($_____)

ARTICLE 4. **CONTRACT DOCUMENTS.** The Contract Documents consist of the following documents which are either attached to this Agreement or are incorporated herein by reference:

a. This CITY-CONTRACTOR Agreement;

b. The City's Invitation for Bid ##17-09 issued by the Purchasing Department;

c. The Project Manual, **NEWTON HIGHLANDS PLAYGROUND REHABILITATION**, including the Instructions to Bidders; General Conditions; Special Conditions; MWBE/AA Requirements, Wage Rate Requirements and Wage Rate Schedule(s); General Requirements and Project Specifications; and Drawings, if included or referenced therein;

d. Addenda Number(s)_____ ;

e. The Bid Response of the CONTRACTOR submitted for this Project and accompanying documents and certifications;

f. Certificate(s) of Insurance and surety bond(s) submitted by the CONTRACTOR in connection with this Project;

g. Duly authorized and executed Amendments, Change Orders or Work Orders issued by the CITY after execution of this CITY-CONTRACTOR Agreement.

This CITY-CONTRACTOR Agreement, together with the other documents enumerated in this Article, constitute the entire Agreement between the CITY and the CONTRACTOR. The CONTRACTOR represents that its bid was made without condition, qualification or reservation of any kind, except upon the wirtten acknowledge and consent of the CITY.

ARTICLE 5. **ALTERNATES.** The following Alternates have been accepted and their costs are included in the Contract Price stated in Article 3 of this Agreement:

Alternates: N/A

ARTICLE 6. **APPLICABLE STATUTES.** All applicable federal, state and local laws and regulations are incorporated herein by reference and the Contractor agrees to comply with same.

IN WITNESS WHEREOF, the parties have caused this instrument to be executed under seal the day and year first above written.

CONTRACTOR

By_____

Print Name_____

Title_____

Date_____

Affix Corporate Seal Here

Certified that City funds are available in the following account numbers:

_____

(CD15-032) - $99,000.00 - CDBG

I further certify that the Mayor, or his designee, is authorized is execute contracts and approve change orders.

By_____
Comptroller of Accounts

Date_____

CITY OF NEWTON

By_____
Chief Procurement Officer

Date_____

By_____
Director of Parks and Recreation

Date_____

Approved as to Legal Form and Character

By_____
Associate City Solicitor

Date_____

CONTRACT AND BONDS APPROVED

By_____
Mayor *or his designee*

Date_____

CERTIFICATE OF AUTHORITY - CORPORATE

1. I hereby certify that I am the Clerk/Secretary of _____
(insert full name of Corporation)

2. corporation, and that _____
(insert the name of officer who signed the **contract and bonds**.)

3. is the duly elected _____
(insert the title of the officer in line 2)

4. of said corporation, and that on _____
(insert a date that is ***ON OR BEFORE*** the date the officer signed the **contract and bonds**.)

at a duly authorized meeting of the Board of Directors of said corporation, at which all the directors were present or waived notice, it was voted that

5. _____ the _____
(insert **name** from line 2) (insert **title** from line 3)

of this corporation be and hereby is authorized to execute contracts and bonds in the name and on behalf of said corporation, and affix its Corporate Seal thereto, and such execution of any contract of obligation in this corporation's name and on its behalf, with or without the Corporate Seal, shall be valid and binding upon this corporation; and that the above vote has not been amended or rescinded and remains in full force and effect as of the date set forth below.

6. ATTEST: _____ *AFFIX CORPORATE SEAL HERE*
(Signature of **Clerk or Secretary**)*

7. Name: _____
(Please print or type name in line 6)*

8. Date: _____
(insert a date that is ***ON OR AFTER*** the date the officer signed the **contract and bonds**.)

* The name and signature inserted in lines 6 & 7 **must** be that of the **Clerk or Secretary** of the corporation.

CERTIFICATION OF TAX COMPLIANCE

Pursuant to M.G.L. c.62C, §49A and requirements of the City, the undersigned acting on behalf of the Contractor certifies under the penalties of perjury that the Contractor is in compliance with all laws of the Commonwealth relating to taxes including payment of all local taxes, fees, assessments, betterments and any other local or municipal charges (unless the Contractor has a pending abatement application or has entered into a payment agreement with the entity to which such charges were owed), reporting of employees and contractors, and withholding and remitting child support.*

_____
**Signature of Individual (Mandatory)

_____
*** Contractor's Social Security Number (Voluntary) or Federal Identification Number

Print Name: _____

Date: _____

OR

_____
Company Name
(Corporation, Partnership, LLC, etc.)

By: _____
**Corporate Officer (Mandatory)

Print Name: _____

Date: _____

* The provision in this Certification relating to child support applies only when the Contractor is an individual.

** Approval of a contract or other agreement will not be granted until the City receives a signed copy of this Certification.

*** Your social security number may be furnished to the Massachusetts Department of Revenue to determine whether you have met tax filing or tax payment obligations. Providers who fail to correct their non-filing or delinquency will not have a contract or other agreement issued, renewed, or extended.

CITY OF NEWTON, MASSACHUSETTS

PAYMENT BOND

Know All Men By These Presents:

That we, _____, as PRINCIPAL, and _____, as SURETY, are held and firmly bound unto the City of Newton as Obligee, in the sum of

dollars **($_____)** to be paid to the Obligee, for which payments well and truly to be made, we bind ourselves, our respective heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Whereas, the said PRINCIPAL has made a contract with the Obligee, bearing the date of _____ _, 2016, for the construction of _____ in Newton, Massachusetts.
(Project Title)

Now, the conditions of this obligation are such that if the PRINCIPAL and all Sub-contractors under said contract shall pay for all labor performed or furnished and for all materials used or employed in said contract and in any and all duly authorized modifications, alterations, extensions of time, changes or additions to said contract that may hereafter be made, notice to the SURETY of such modifications, alterations, extensions of time, changes or additions being hereby waived, the foregoing to include any other purposes or items set out in, and to be subject to, provisions of M.G.L. c.30, §39A, and M.G.L. c.149, §29, as amended, then this obligation shall become null and void; otherwise it shall remain in full force, virtue and effect.

In Witness Whereof, the PRINCIPAL and SURETY have hereto set their hands and seals this ___day of_____2016.

PRINCIPAL	SURETY
_____	_____
BY_____	BY _____
(SEAL)	(ATTORNEY-IN-FACT) (SEAL)
_____ (Title)	
ATTEST: _____	ATTEST: _____

CITY OF NEWTON

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

1.0 DEFINITIONS

1.1 THE CONTRACT DOCUMENTS

The term "Contract Documents" sometimes also referred to as the "Contract", means the contract entered into between the City of Newton (hereinafter "City") and the Contractor. It includes the Invitation for Bid, General Bid Form, Contract Form, these General Conditions of the Contract, Supplements and Amendments to the General Conditions (if any), Contract Specifications, Drawings, all addenda issued prior to execution of the contract, the Bid Bond, the Labor and Material Payment Bond, or other assurances of completion, the applicable wage rate determinations, and other documents listed in the Agreement and modifications issued after execution of the contract.

1.2 THE WORK

The term "Work", sometimes also referred to as the "Project", means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligation.

1.3 OWNER

The term "Owner" is the City of Newton.

1.4 CONTRACT OFFICER

The term "Contract Officer" means the person appointed by the Owner to administer the terms of the Contract between the Owner and the Contractor, who is also empowered to take certain actions under this Agreement.

1.5 CONTRACTOR

1.5.1 The Contractor, sometimes referred to as the General Contractor, is the person or entity identified as such throughout the Contract Documents as if singular in number. The term Contractor means the Contractor or its authorized representative.

1.5.2 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures, and for coordinating all portions of the Work under the Contract.

1.6 SUBSTANTIAL COMPLETION

The term "Substantial Completion" means the value of the work remaining to be performed by the Contractor is, in the estimate of the awarding authority, less than one percent (1%) of the original contract price.

2.0 CONTRACT ADMINISTRATION

2.1 PRE-CONSTRUCTION CONFERENCE

2.1.1 Prior to commencement of the Work, the Contractor shall meet in conference with representatives of the Owner regarding the Owner's requirements under the Contract for administration of the quality assurance program, safety program, labor provisions, the schedule of work, and other Contract procedures.

2.1.2 The Contractor shall begin work upon receipt of a written Notice to Proceed from the Contract Officer or designee. The Contractor shall not begin work prior to receiving such notice.

2.2 CONTRACT PERIOD

The Contractor shall complete all work required under this contract within the timeframe specified elsewhere in this document, or within the time schedule established in the notice to proceed issued by the Contracting Officer.

2.3 REJECTION OF DEFECTIVE MATERIALS AND WORK

The Owner's inspection of the Work shall not relieve the Contractor of any of its responsibilities to fulfill the Contract obligations, and defective work shall be corrected without cost to the Owner. Unsuitable work may be rejected by the Owner, notwithstanding that such work and materials have been previously overlooked or misjudged by the Owner and accepted 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 correct such defect in a manner satisfactory to the Owner, and if any material brought upon the site for use in the Work, or selected for the same, shall be rejected by the Owner as unsuitable or not in conformity with the Contract requirements, the Contractor shall forthwith remove such materials from the vicinity of the Work.

2.4 CHANGES

2.4.1 All changes in the work including any increase, decrease, or other equitable adjustment in the Contract price or in the time for performing the Contract, shall be authorized in writing by the Owner and/or Contract Officer prior to commencement.

2.5 CONTRACT PRICE

The Contract Price is stated in the Contract Form, and including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

2.6 APPLICATIONS FOR PAYMENT

2.6.1 Once each month, on a date established by the Owner at the beginning of the Work, the Contractor shall deliver to the Owner an itemized Application for Payment, supported by such data substantiating the Contractor's right to payment as the Owner may require, and reflecting a minimum of 5% retainage until the final acceptance and payment by the Owner.

2.6.2 The Owner shall make payment to the Contractor within 30 days of receipt of said application, less any applicable retainage.

2.6.3 The Owner may make changes in any application for payment submitted by the Contractor for:

i. Retention based on the value of its claims against the Contractor,
ii. Retention of 5% of the approved amount of the Application for Payment.

2.7 FINAL PAYMENT

The acceptance by the Contractor of the last payment due under this Contract or the execution of the Final Certificate of Completion, shall operate as a release to the Owner from all claims and liability related to this Contract.

2.8 GUARANTY AND WARRANTY

2.8.1 WARRANTY

The Contractor warrants to the Owner that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

2.8.2 GENERAL GUARANTY

If at any time during the period of one (1) year from the date of Substantial Completion of the Work to be performed under this Contract, any part of the Work shall, in the reasonable determination of the Owner, require replacing or repairing due to the fact that it is broken, defective, or otherwise does not conform to the Contract Documents, the Owner will notify the Contractor to make the required repairs or replacement. If the Contractor shall neglect to commence such repairs or replacement to the satisfaction of the Owner within ten (10) days from the date of giving or mailing such notice, then the Owner may employ other persons to make the same. The Contractor agrees, upon demand, to pay to the Owner all amounts which the Owner expends for such repairs or replacements. During this one year guarantee period any corrective work shall be performed in accordance with the applicable terms of this Contract. For items of work completed after use and occupancy has been taken, the one year guarantee shall commence at the time the Owner accepts such items. This one year guarantee shall not limit any express guaranty or warranty provided elsewhere in the Contract.

2.9 INSURANCE REQUIREMENTS

2.9.1 The Contractor shall provide insurance coverage as listed below. This insurance shall be provided at the Contractor's expense and shall be in full force and effect during the full term of this Contract.

WORKER'S COMPENSATION

Worker's Compensation:	Per M.G.L. c.. l49, s. 34 and c.. l52 as amended.

COMMERCIAL GENERAL LIABILITY

Personal Injury	$500,000 each occurrence $1,000,000 aggregate
Property Damage	$500,000 each occurrence $1,000,000 aggregate

VEHICLE LIABILITY

Personal Injury	$500,000 each person $1,000,000 aggregate
Property Damage	$300,000 each occurrence $500,000 aggregate

2.9.2 OWNER AS CO-INSURED

The Owner shall be named as additional insureds on the Contractor's Liability Policies.

2.9.3 CERTIFICATES OF INSURANCE, POLICIES

i. The Contractor shall not commence the work until proof of compliance with this Section 2.9 has been furnished to the Owner by submitting one copy of a properly endorsed insurance certificate issued by a company authorized to write insurance in the Commonwealth. This certificate shall indicate that the contractual liability coverage is in force.

ii. The Contractor shall file the original and one certified copy of all policies with the Owner within fifteen (15) days after contract award. If the Owner is damaged by the Contractor's failure to maintain such insurance and to so notify the Owner, then the Contractor shall be responsible for all reasonable costs attributable thereto.

2.9.4 CANCELLATION

Cancellation of any insurance required by this contract, whether by the insurer or the insured, shall not be valid unless written notice thereof is given by the party proposing cancellation to the other party and Owner at least thirty days prior to the effective date thereof, which shall be expressed in said notice.

2.10 INDEMNIFICATION

The Contractor shall take all responsibility for the Work and take all precautions for preventing injuries to persons and property in or about the Work; shall bear all losses resulting to or on account of the amount or character of the Work. The Contractor shall pay or cause payment to be made for all labor performed or furnished and for all materials used or employed in carrying out this Contract. The Contractor shall assume the defense of, and indemnify and save harmless the Owner, and the Owner's officers and agents from all claims relating to labor performed or furnished and materials used or employed for the Work; to inventions, patents and patent rights used in and in doing the Work unless such patent infringement is due to a product or process specified by the Owner; to injuries to any person or corporation received or sustained by or from the Contractor and any employees, and subcontractors and employees, in doing the work, or in consequence of any improper materials, implements or labor used or employed therein; and to any act, omission or neglect of the Contractor and any employees therein.

2.11 BONDS

The Contractor shall provide the Owner with a performance and with a payment or labor and materials bond in the form provided by the Owner, executed by a surety company licensed by the Commonwealth of Massachusetts' Division of Insurance. Such bond shall be in an amount equal to at least one half of the Contract price unless otherwise stated in the Contract Documents. All bonds shall be accompanied by a current power of attorney.

2.12 TERMINATION

2.12.1 TERMINATION FOR CAUSE

i. The Owner may terminate this contract for cause if it determines that any of the following circumstances have occurred:

a. The Contractor is adjudged bankrupt or has made a general assignment for the benefit of its creditors.
b. A receiver has been appointed of the Contractor's property.
c. All or a part of the Work has been abandoned.
d. The Contractor has sublet or assigned all or any portion of the Work, the Contract, or claims thereunder, without the prior written consent of the Owner, except as provided in the Contract.
e. The Owner has determined that the rate of progress required on the project is not being met.
f. The Contractor has substantially violated any provisions of this Contract.

ii. The Owner may complete the Work, or any part thereof, and charge its expense of so completing the Work or part thereof, to the Contractor.

iii. The Owner may take possession of and use any materials, machinery, implements and tools found upon the site of said Work. The Owner shall not be liable for any depreciation, loss or damage to said materials, machinery, implements or tools during said use and the Contractor shall be solely responsible for their removal from the Project site after the Owner has no further use for them.

2.12.2 TERMINATION - NO FAULT

i. In the event that this Contract is terminated by the Owner, prior to the completion of construction and termination is not based on a reason listed in Paragraph 2.12.1, the Contractor shall be compensated for its costs incurred on the Project, including reasonable costs of de-mobilization, covering the period of time between the last approved application for payment and the date of termination.

ii. Payment by the Owner pursuant to Section 2.7 shall be considered to fully compensate the Contractor for all claims and expenses and those of any consultants, subcontractors, and suppliers, directly or indirectly attributable to the termination, including any claims for lost profits.

2.13 PERMITS, FEES, AND NOTICES

2.13.1 The Contractor shall secure and the Owner shall pay for the building permit, if required. The Contractor shall coordinate all efforts required to obtain this permit. All other permits and governmental fees, licenses, and inspections necessary for proper execution and completion of the Work shall be secured and paid for by the Contractor.

2.13.2 The Contractor shall comply with and give notices required by laws, ordinances rules, regulations, and lawful orders of public authorities bearing on performance of the Work.

2.13.3 If the Contractor performs Work that it knows or reasonably should know is contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs.

2.14 SAFETY REQUIREMENTS

2.14.1 The Contractor shall comply with all Federal, State, and local safety laws and regulations applicable to the Work performed under this Contract.

2.15 TEMPORARY HEATING

Not required; do not install Removal & Installation of Gym Flooring in any space which is not heated properly.

2.16 AVAILABILITY AND USE OF UTILITY SERVICES

2.16.1 The City shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the Contract. Unless otherwise provided in the Contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the City or, where the utility is produced by the City, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

2.17 DISPUTES

2.17.1 "Claim," as used in this section, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to the contract. A claim arising under the Contract, unlike a claim relating to the Contract, is a claim that can be resolved under a Contract clause that provides for the relief sought by the claimant. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim. The submission may be converted to a claim by complying with the requirements of this section, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

2.17.2 All disputes arising under or relating to this Contract, including any claims for damages for the alleged breach thereof which are not disposed of by agreement, shall be resolved under this section.

2.17.3 All claims by the Contractor shall be made in writing and submitted to the Contract Officer for a written decision. A claim by the City against the Contractor shall be subject to a written decision by the Contract Officer.

2.17.4 The Contract Officer shall, within thirty (30) days after receipt of the request, decide the claim or notify the Contractor of the date by which the decision will be made.

2.17.5 The Contract Officer's decision shall be final unless the Contractor (1) appeals in writing to a higher level in the City, (2) refers the appeal to an independent mediator or arbitrator, or (3) files suit in a court of competent jurisdiction. Such appeal must be made within thirty (30) days after receipt of the Contract Officer's decision.

2.17.6 The Contractor shall proceed diligently with performance of this Contract and/or any authorized change thereof, pending final resolution of any request for relief, claim, appeal, or action arising under or relating to the Contract and/or any authorized change thereof, and comply with any decision of the Contract Officer.

2.18 LIQUIDATED DAMAGES

2.18.1 If the Contractor fails to complete the Work within the time specified in the contract, or any extension thereof, the Contractor shall pay to the City as liquidated damages, the sum of $250.00 for each day of delay. Completion dates are specified in the Contract for separate phases of the work, and the amount of liquidated damages shall be assessed on each and every phase which is delayed. In the contect of this paragraph, “delay” means failure to provide Newton Highlands Playground Rehabilitation. To the extent that the Contractor's delay or nonperformance is excused under another section in this Contract, liquidated damages shall not be due the City. The Contractor remains liable for damages caused other than by delay.

2.18.2 If the City terminates the Contractor's right to proceed pursuant to section 2.12.1, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the Work together with any increased costs to the City in completing the Work.

2.18.3 If the City does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the Work is completed or accepted.

3.0 SALES TAX EXEMPTION AND OTHER TAXES

3.0.1 To the extent that materials and supplies are used or incorporated in the performance of this Contract, the Contractor is considered an exempt purchaser under the Massachusetts Sales Act, Chapter 14 of the Acts of 1966.

3.0.2 The Contractor shall be responsible for paying all other taxes and tariffs of any sort, related to the Work.

3.1 PROHIBITION AGAINST LIENS

The Contractor is prohibited from placing a lien on the City's property. This prohibition shall apply to all subcontractors at any tier and all materials suppliers.

3.2 ORDER OF PRECEDENCE

In the event of a conflict between these General Conditions and the Specifications, the General Conditions shall prevail. In the event of a conflict between the Contract and any applicable state or local law or regulation, the state or local law or regulation shall prevail; provided that such state or local law or regulation does not conflict with, or is less restrictive than applicable federal law, regulation, or Executive Order. In the event of such a conflict, applicable federal law, regulation, and Executive Order shall prevail.

3.3 EXAMINATION AND RETENTION OF CONTRACTOR'S RECORDS

The City of Newton shall, until three (3) years after final payment under this Contract, have access to and the right to examine any of the Contractor's directly pertinent books, documents, papers, or other records involving transactions related to this Contract for the purpose of making audit, examination, excerpts, and/or transcriptions.

END OF GENERAL CONDITIONS

CITY OF NEWTON

WAGE RATE REQUIREMENTS

1. GENERAL

A. This section summarizes the requirements for the payment of wages to laborers and mechanics employed under the Contract.

B. Other duties and requirements of law which may not be specified in this section apply and are inherently a part of the Contract.

2. WAGE RATES

A. The rate per hour to be paid to mechanics, apprentices, teamsters, chauffeurs, and laborers employed on the Work shall not be less than the rate of wages in the attached "Minimum Wage Rates" as determined by the Commissioner of Labor and Industries. This schedule shall continue to be the minimum rate of wages for said employees during the life of this Contract.

B. Keep posted on the site a legible copy of said schedule. Keep on file the wage rates and classifications of labor employed on this Work in order that they may be available for inspection by the Owner, Administrator, or the Architect.

C. Apprentices employed pursuant to this determination of wage rates must be registered and approved by the State Apprenticeship Council wherever rates for journeymen or apprentices are not listed.

D. Pay reserve police officers employed on the Work the prevailing rate of wages paid to regular police officers as required by M.G.L. c149, Sec. 34B, as amended. Such police officers shall be covered by Workmen's Compensation Insurance and Employers Liability Insurance by the Contractor.

E. **The Contractor and all subcontractors shall, on a weekly basis throughout the term of the contract, provide to the City of Newton certified payroll affidavits in pdf format verifying compliance with M.G.L. c.149, Sec. 27, 27A and 27B.** The Contractor is obiligated to provide such records to the City directly on a weekly basis. The City may assess a penalty of $100 for each day beyond the required submission date that such records are received, which amount shall be deducted from any amounts to the Contractor from the City. In the event of chronic late submissions, the City shall report the same to the Office of the Attorney General.

F. The Contractor and all subcontractors shall provide a Statement of Compliance within 15 days of the completion of its portion of the work. This statement shall be submitted to the Owner on the form found elsewhere in this section.

G. The Contractor shall maintain accurate and complete records, including payroll records, during the Contract term and for three years thereafter.

END OF SECTION

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

WILLIAM D MCKINNEY
Director

Awarding Authority: City of Newton

Contract Number: 17-09 **City/Town:** NEWTON

Description of Work: Newton Highlands Playground Rehabilitation

Job Location: Dedham Street

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

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

Issue Date: 08/08/2016 **Wage Request Number:** 20160808-039

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Construction						
(2 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	08/01/2016	$33.25	$10.91	$10.08	$0.00	$54.24
	12/01/2016	$33.25	$10.91	$10.89	$0.00	$55.05
(3 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	08/01/2016	$33.32	$10.91	$10.08	$0.00	$54.31
	12/01/2016	$33.32	$10.91	$10.89	$0.00	$55.12
(4 & 5 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	08/01/2016	$33.44	$10.91	$10.08	$0.00	$54.43
	12/01/2016	$33.44	$10.91	$10.89	$0.00	$55.24
ADS/SUBMERSIBLE PILOT *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2015	$88.29	$9.80	$19.23	$0.00	$117.32
AIR TRACK OPERATOR *LABORERS - ZONE 1*	06/01/2016	$36.60	$7.45	$13.80	$0.00	$57.85
For apprentice rates see "Apprentice- LABORER"	12/01/2016	$37.60	$7.45	$13.80	$0.00	$58.85
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	12/01/2015	$34.38	$10.40	$5.95	$0.00	$50.73
ASPHALT RAKER *LABORERS - ZONE 1*	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
For apprentice rates see "Apprentice- LABORER"	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BACKHOE/FRONT-END LOADER *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER *LABORERS - ZONE 1*	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
For apprentice rates see "Apprentice- LABORER"	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35
BLOCK PAVER, RAMMER / CURB SETTER *LABORERS - ZONE 1*	06/01/2016	$36.60	$7.45	$13.80	$0.00	$57.85
For apprentice rates see "Apprentice- LABORER"	12/01/2016	$37.60	$7.45	$13.80	$0.00	$58.85
BOILER MAKER *BOILERMAKERS LOCAL 29*	01/01/2016	$41.62	$6.97	$16.21	$0.00	$64.80
	01/01/2017	$42.92	$6.97	$16.21	$0.00	$66.10

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *BOILERMAKER - Local 29*

Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	$27.05	$6.97	$10.54	$0.00	$44.56
2	65	$27.05	$6.97	$10.54	$0.00	$44.56
3	70	$29.13	$6.97	$11.35	$0.00	$47.45
4	75	$31.22	$6.97	$12.16	$0.00	$50.35
5	80	$33.30	$6.97	$12.97	$0.00	$53.24
6	85	$35.38	$6.97	$13.78	$0.00	$56.13
7	90	$37.46	$6.97	$14.59	$0.00	$59.02
8	95	$39.54	$6.97	$15.40	$0.00	$61.91

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	$27.90	$6.97	$10.54	$0.00	$45.41
2	65	$27.90	$6.97	$10.54	$0.00	$45.41
3	70	$30.04	$6.97	$11.35	$0.00	$48.36
4	75	$32.19	$6.97	$12.16	$0.00	$51.32
5	80	$34.34	$6.97	$12.97	$0.00	$54.28
6	85	$36.48	$6.97	$13.78	$0.00	$57.23
7	90	$38.63	$6.97	$14.59	$0.00	$60.19
8	95	$40.77	$6.97	$15.40	$0.00	$63.14

Notes:

Apprentice to Journeyworker Ratio:1:5

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) *BRICKLAYERS LOCAL 3 (NEWTON)*	08/01/2016	$50.76	$10.18	$19.22	$0.00	$80.16
	02/01/2017	$51.33	$10.18	$19.22	$0.00	$80.73

Issue Date: 08/08/2016 **Wage Request Number:** 20160808-039 **Page 3 of 34**

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 08/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.38	$10.18	$19.22	$0.00	$54.78
2	60	$30.46	$10.18	$19.22	$0.00	$59.86
3	70	$35.53	$10.18	$19.22	$0.00	$64.93
4	80	$40.61	$10.18	$19.22	$0.00	$70.01
5	90	$45.68	$10.18	$19.22	$0.00	$75.08

Effective Date - 02/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.67	$10.18	$19.22	$0.00	$55.07
2	60	$30.80	$10.18	$19.22	$0.00	$60.20
3	70	$35.93	$10.18	$19.22	$0.00	$65.33
4	80	$41.06	$10.18	$19.22	$0.00	$70.46
5	90	$46.20	$10.18	$19.22	$0.00	$75.60

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
CAISSON & UNDERPINNING BOTTOM MAN *LABORERS - FOUNDATION AND MARINE*	06/01/2016	$36.95	$7.45	$14.00	$0.00	$58.40
	12/01/2016	$37.95	$7.45	$14.00	$0.00	$59.40
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING LABORER *LABORERS - FOUNDATION AND MARINE*	06/01/2016	$35.80	$7.45	$14.00	$0.00	$57.25
	12/01/2016	$36.80	$7.45	$14.00	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING TOP MAN *LABORERS - FOUNDATION AND MARINE*	06/01/2016	$35.80	$7.45	$14.00	$0.00	$57.25
	12/01/2016	$36.80	$7.45	$14.00	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						
CARBIDE CORE DRILL OPERATOR *LABORERS - ZONE 1*	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35
For apprentice rates see "Apprentice- LABORER"						
CARPENTER *CARPENTERS -ZONE 2 (Eastern Massachusetts)*	03/01/2016	$37.10	$9.80	$16.82	$0.00	$63.72
	09/01/2016	$38.08	$9.80	$16.82	$0.00	$64.70
	03/01/2017	$39.05	$9.80	$16.82	$0.00	$65.67
	09/01/2017	$40.06	$9.80	$16.82	$0.00	$66.68
	03/01/2018	$41.06	$9.80	$16.82	$0.00	$67.68
	09/01/2018	$42.10	$9.80	$16.82	$0.00	$68.72
	03/01/2019	$43.13	$9.80	$16.82	$0.00	$69.75

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CARPENTER - Zone 2 Eastern MA*

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$18.55	$9.80	$1.63	$0.00	$29.98
2	60	$22.26	$9.80	$1.63	$0.00	$33.69
3	70	$25.97	$9.80	$11.93	$0.00	$47.70
4	75	$27.83	$9.80	$11.93	$0.00	$49.56
5	80	$29.68	$9.80	$13.56	$0.00	$53.04
6	80	$29.68	$9.80	$13.56	$0.00	$53.04
7	90	$33.39	$9.80	$15.19	$0.00	$58.38
8	90	$33.39	$9.80	$15.19	$0.00	$58.38

Effective Date - 09/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.04	$9.80	$1.63	$0.00	$30.47
2	60	$22.85	$9.80	$1.63	$0.00	$34.28
3	70	$26.66	$9.80	$11.93	$0.00	$48.39
4	75	$28.56	$9.80	$11.93	$0.00	$50.29
5	80	$30.46	$9.80	$13.56	$0.00	$53.82
6	80	$30.46	$9.80	$13.56	$0.00	$53.82
7	90	$34.27	$9.80	$15.19	$0.00	$59.26
8	90	$34.27	$9.80	$15.19	$0.00	$59.26

Notes:

Apprentice to Journeyworker Ratio:1:5

CEMENT MASONRY/PLASTERING *BRICKLAYERS LOCAL 3 (NEWTON)*	01/01/2016	$46.44	$10.90	$18.71	$1.30	$77.35

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

Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.22	$10.90	$12.21	$0.00	$46.33
2	60	$27.86	$10.90	$13.71	$1.30	$53.77
3	65	$30.19	$10.90	$14.71	$1.30	$57.10
4	70	$32.51	$10.90	$15.71	$1.30	$60.42
5	75	$34.83	$10.90	$16.71	$1.30	$63.74
6	80	$37.15	$10.90	$17.71	$1.30	$67.06
7	90	$41.80	$10.90	$18.71	$1.30	$72.71

Notes:

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

Apprentice to Journeyworker Ratio:1:3

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CHAIN SAW OPERATOR *LABORERS - ZONE 1*	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35
For apprentice rates see "Apprentice- LABORER"						
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$45.23	$10.00	$15.15	$0.00	$70.38
	12/01/2016	$46.48	$10.00	$15.15	$0.00	$71.63
	06/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
	12/01/2017	$48.48	$10.00	$15.15	$0.00	$73.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
COMPRESSOR OPERATOR *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$30.40	$10.00	$15.15	$0.00	$55.55
	12/01/2016	$31.27	$10.00	$15.15	$0.00	$56.42
	06/01/2017	$31.96	$10.00	$15.15	$0.00	$57.11
	12/01/2017	$32.65	$10.00	$15.15	$0.00	$57.80
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DELEADER (BRIDGE) *PAINTERS LOCAL 35 - ZONE 2*	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 - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.23	$7.85	$0.00	$0.00	$33.08
2	55	$27.75	$7.85	$3.66	$0.00	$39.26
3	60	$30.28	$7.85	$3.99	$0.00	$42.12
4	65	$32.80	$7.85	$4.32	$0.00	$44.97
5	70	$35.32	$7.85	$14.11	$0.00	$57.28
6	75	$37.85	$7.85	$14.44	$0.00	$60.14
7	80	$40.37	$7.85	$14.77	$0.00	$62.99
8	90	$45.41	$7.85	$15.44	$0.00	$68.70

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.71	$7.85	$0.00	$0.00	$33.56
2	55	$28.28	$7.85	$3.66	$0.00	$39.79
3	60	$30.85	$7.85	$3.99	$0.00	$42.69
4	65	$33.42	$7.85	$4.32	$0.00	$45.59
5	70	$35.99	$7.85	$14.11	$0.00	$57.95
6	75	$38.56	$7.85	$14.44	$0.00	$60.85
7	80	$41.13	$7.85	$14.77	$0.00	$63.75
8	90	$46.27	$7.85	$15.44	$0.00	$69.56

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN *LABORERS - ZONE 1*	12/01/2015	$35.50	$7.45	$13.55	$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 1* For apprentice rates see "Apprentice- LABORER"	12/01/2015	$36.50	$7.45	$13.55	$0.00	$57.50
DEMO: BURNERS *LABORERS - ZONE 1* For apprentice rates see "Apprentice- LABORER"	12/01/2015	$36.25	$7.45	$13.55	$0.00	$57.25
DEMO: CONCRETE CUTTER/SAWYER *LABORERS - ZONE 1* For apprentice rates see "Apprentice- LABORER"	12/01/2015	$36.50	$7.45	$13.55	$0.00	$57.50
DEMO: JACKHAMMER OPERATOR *LABORERS - ZONE 1* For apprentice rates see "Apprentice- LABORER"	12/01/2015	$36.25	$7.45	$13.55	$0.00	$57.25
DEMO: WRECKING LABORER *LABORERS - ZONE 1* For apprentice rates see "Apprentice- LABORER"	12/01/2015	$35.50	$7.45	$13.55	$0.00	$56.50
DIRECTIONAL DRILL MACHINE OPERATOR *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2015	$58.86	$9.80	$19.23	$0.00	$87.89
DIVER TENDER *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2015	$42.04	$9.80	$19.23	$0.00	$71.07
DIVER TENDER (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2015	$63.06	$9.80	$19.23	$0.00	$92.09
DIVER/SLURRY (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2015	$88.23	$9.80	$19.23	$0.00	$117.26
DRAWBRIDGE OPERATOR (Construction) *ELECTRICIANS LOCAL 103* For apprentice rates see "Apprentice- ELECTRICIAN"	03/01/2016	$46.17	$13.00	$16.39	$0.00	$75.56
ELECTRICIAN *ELECTRICIANS LOCAL 103*	03/01/2016	$46.17	$13.00	$16.39	$0.00	$75.56

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELECTRICIAN - Local 103*
Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$18.47	$13.00	$0.55	$0.00	$32.02
2	40	$18.47	$13.00	$0.55	$0.00	$32.02
3	45	$20.78	$13.00	$12.34	$0.00	$46.12
4	45	$20.78	$13.00	$12.34	$0.00	$46.12
5	50	$23.09	$13.00	$12.71	$0.00	$48.80
6	55	$25.39	$13.00	$13.07	$0.00	$51.46
7	60	$27.70	$13.00	$13.44	$0.00	$54.14
8	65	$30.01	$13.00	$13.81	$0.00	$56.82
9	70	$32.32	$13.00	$14.18	$0.00	$59.50
10	75	$34.63	$13.00	$14.55	$0.00	$62.18

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

Apprentice to Journeyworker Ratio:2:3***

ELEVATOR CONSTRUCTOR *ELEVATOR CONSTRUCTORS LOCAL 4*	01/01/2016	$54.53	$14.43	$14.96	$0.00	$83.92
	01/01/2017	$55.86	$15.28	$15.71	$0.00	$86.85

Apprentice - *ELEVATOR CONSTRUCTOR - Local 4*
Effective Date - 01/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.27	$14.43	$0.00	$0.00	$41.70
2	55	$29.99	$14.43	$14.96	$0.00	$59.38
3	65	$35.44	$14.43	$14.96	$0.00	$64.83
4	70	$38.17	$14.43	$14.96	$0.00	$67.56
5	80	$43.62	$14.43	$14.96	$0.00	$73.01

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.93	$15.28	$0.00	$0.00	$43.21
2	55	$30.72	$15.28	$15.71	$0.00	$61.71
3	65	$36.31	$15.28	$15.71	$0.00	$67.30
4	70	$39.10	$15.28	$15.71	$0.00	$70.09
5	80	$44.69	$15.28	$15.71	$0.00	$75.68

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*	01/01/2016	$38.17	$14.43	$14.96	$0.00	$67.56
	01/01/2017	$39.10	$15.28	$15.71	$0.00	$70.09

For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FENCE & GUARD RAIL ERECTOR *LABORERS - ZONE 1*	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35
For apprentice rates see "Apprentice- LABORER"						
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	05/01/2016	$41.03	$10.00	$14.90	$0.00	$65.93
	11/01/2016	$41.62	$10.00	$14.90	$0.00	$66.52
	05/01/2017	$42.50	$10.00	$14.90	$0.00	$67.40
	11/01/2017	$43.23	$10.00	$14.90	$0.00	$68.13
	05/01/2018	$43.94	$10.00	$14.90	$0.00	$68.84
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	05/01/2016	$42.47	$10.00	$14.90	$0.00	$67.37
	11/01/2016	$43.07	$10.00	$14.90	$0.00	$67.97
	05/01/2017	$43.96	$10.00	$14.90	$0.00	$68.86
	11/01/2017	$44.69	$10.00	$14.90	$0.00	$69.59
	05/01/2018	$45.41	$10.00	$14.90	$0.00	$70.31
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	05/01/2016	$21.88	$10.00	$14.90	$0.00	$46.78
	11/01/2016	$22.23	$10.00	$14.90	$0.00	$47.13
	05/01/2017	$22.76	$10.00	$14.90	$0.00	$47.66
	11/01/2017	$23.18	$10.00	$14.90	$0.00	$48.08
	05/01/2018	$23.61	$10.00	$14.90	$0.00	$48.51
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIRE ALARM INSTALLER *ELECTRICIANS LOCAL 103*	03/01/2016	$46.17	$13.00	$16.39	$0.00	$75.56
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINTENANCE / COMMISSIONING *ELECTRICIANS LOCAL 103*	03/01/2016	$34.63	$13.00	$14.55	$0.00	$62.18
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"						
FIREMAN (ASST. ENGINEER) *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$36.71	$10.00	$15.15	$0.00	$61.86
	12/01/2016	$37.75	$10.00	$15.15	$0.00	$62.90
	06/01/2017	$38.59	$10.00	$15.15	$0.00	$63.74
	12/01/2017	$39.42	$10.00	$15.15	$0.00	$64.57
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER *LABORERS - ZONE 1*	06/01/2016	$20.50	$7.45	$13.80	$0.00	$41.75
	12/01/2016	$20.50	$7.45	$13.80	$0.00	$41.75
For apprentice rates see "Apprentice- LABORER"						
FLOORCOVERER *FLOORCOVERERS LOCAL 2168 ZONE 1*	03/01/2016	$42.13	$9.80	$17.62	$0.00	$69.55

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *FLOORCOVERER - Local 2168 Zone 1*

Effective Date - 03/01/2016

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

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

FORK LIFT/CHERRY PICKER *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GENERATOR/LIGHTING PLANT/HEATERS *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$30.40	$10.00	$15.15	$0.00	$55.55
	12/01/2016	$31.27	$10.00	$15.15	$0.00	$56.42
	06/01/2017	$31.96	$10.00	$15.15	$0.00	$57.11
	12/01/2017	$32.65	$10.00	$15.15	$0.00	$57.80
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) *GLAZIERS LOCAL 35 (ZONE 2)*	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 - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.98	$7.85	$0.00	$0.00	$27.83
2	55	$21.98	$7.85	$3.66	$0.00	$33.49
3	60	$23.98	$7.85	$3.99	$0.00	$35.82
4	65	$25.97	$7.85	$4.32	$0.00	$38.14
5	70	$27.97	$7.85	$14.11	$0.00	$49.93
6	75	$29.97	$7.85	$14.44	$0.00	$52.26
7	80	$31.97	$7.85	$14.77	$0.00	$54.59
8	90	$35.96	$7.85	$15.44	$0.00	$59.25

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.46	$7.85	$0.00	$0.00	$28.31
2	55	$22.50	$7.85	$3.66	$0.00	$34.01
3	60	$24.55	$7.85	$3.99	$0.00	$36.39
4	65	$26.59	$7.85	$4.32	$0.00	$38.76
5	70	$28.64	$7.85	$14.11	$0.00	$50.60
6	75	$30.68	$7.85	$14.44	$0.00	$52.97
7	80	$32.73	$7.85	$14.77	$0.00	$55.35
8	90	$36.82	$7.85	$15.44	$0.00	$60.11

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

HOISTING ENGINEER/CRANES/GRADALLS *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *OPERATING ENGINEERS - Local 4*

Effective Date - 06/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$24.33	$10.00	$0.00	$0.00	$34.33
2	60	$26.54	$10.00	$15.15	$0.00	$51.69
3	65	$28.75	$10.00	$15.15	$0.00	$53.90
4	70	$30.96	$10.00	$15.15	$0.00	$56.11
5	75	$33.17	$10.00	$15.15	$0.00	$58.32
6	80	$35.38	$10.00	$15.15	$0.00	$60.53
7	85	$37.60	$10.00	$15.15	$0.00	$62.75
8	90	$39.81	$10.00	$15.15	$0.00	$64.96

Effective Date - 12/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$25.01	$10.00	$0.00	$0.00	$35.01
2	60	$27.29	$10.00	$15.15	$0.00	$52.44
3	65	$29.56	$10.00	$15.15	$0.00	$54.71
4	70	$31.84	$10.00	$15.15	$0.00	$56.99
5	75	$34.11	$10.00	$15.15	$0.00	$59.26
6	80	$36.38	$10.00	$15.15	$0.00	$61.53
7	85	$38.66	$10.00	$15.15	$0.00	$63.81
8	90	$40.93	$10.00	$15.15	$0.00	$66.08

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) *SHEETMETAL WORKERS LOCAL 17 - A*	08/01/2016	$43.31	$10.70	$23.07	$2.31	$79.39
	02/01/2017	$44.41	$10.70	$23.07	$2.31	$80.49
	08/01/2017	$45.51	$10.70	$23.07	$2.31	$81.59
	02/01/2018	$46.66	$10.70	$23.07	$2.31	$82.74
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (ELECTRICAL CONTROLS) *ELECTRICIANS LOCAL 103*	03/01/2016	$46.17	$13.00	$16.39	$0.00	$75.56
For apprentice rates see "Apprentice- ELECTRICIAN"						
HVAC (TESTING AND BALANCING - AIR) *SHEETMETAL WORKERS LOCAL 17 - A*	08/01/2016	$43.31	$10.70	$23.07	$2.31	$79.39
	02/01/2017	$44.41	$10.70	$23.07	$2.31	$80.49
	08/01/2017	$45.51	$10.70	$23.07	$2.31	$81.59
	02/01/2018	$46.66	$10.70	$23.07	$2.31	$82.74
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (TESTING AND BALANCING -WATER) *PIPEFITTERS LOCAL 537*	03/01/2016	$49.19	$9.70	$18.14	$0.00	$77.03
	09/01/2016	$50.19	$9.70	$18.14	$0.00	$78.03
	03/01/2017	$51.19	$9.70	$18.14	$0.00	$79.03
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HVAC MECHANIC *PIPEFITTERS LOCAL 537*	03/01/2016	$49.19	$9.70	$18.14	$0.00	$77.03
	09/01/2016	$50.19	$9.70	$18.14	$0.00	$78.03
	03/01/2017	$51.19	$9.70	$18.14	$0.00	$79.03
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HYDRAULIC DRILLS *LABORERS - ZONE 1*	06/01/2016	$36.60	$7.45	$13.80	$0.00	$57.85
	12/01/2016	$37.60	$7.45	$13.80	$0.00	$58.85
For apprentice rates see "Apprentice- LABORER"						
INSULATOR (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	09/01/2015	$43.81	$11.50	$13.80	$0.00	$69.11
	09/01/2016	$45.81	$11.50	$13.80	$0.00	$71.11
	09/01/2017	$47.81	$11.50	$13.80	$0.00	$73.11
	09/01/2018	$50.06	$11.50	$13.80	$0.00	$75.36
	09/01/2019	$52.56	$11.50	$13.80	$0.00	$77.86

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

Effective Date - 09/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.91	$11.50	$10.05	$0.00	$43.46
2	60	$26.29	$11.50	$10.80	$0.00	$48.59
3	70	$30.67	$11.50	$11.55	$0.00	$53.72
4	80	$35.05	$11.50	$12.30	$0.00	$58.85

Effective Date - 09/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.91	$11.50	$10.05	$0.00	$44.46
2	60	$27.49	$11.50	$10.80	$0.00	$49.79
3	70	$32.07	$11.50	$11.55	$0.00	$55.12
4	80	$36.65	$11.50	$12.30	$0.00	$60.45

Notes:
Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER *IRONWORKERS LOCAL 7 (BOSTON AREA)*	03/16/2016	$43.40	$7.80	$20.85	$0.00	$72.05
	09/16/2016	$44.05	$7.80	$20.85	$0.00	$72.70
	03/16/2017	$44.65	$7.80	$20.85	$0.00	$73.30

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *IRONWORKER - Local 7 Boston*

Effective Date - 03/16/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$26.04	$7.80	$20.85	$0.00	$54.69
2	70	$30.38	$7.80	$20.85	$0.00	$59.03
3	75	$32.55	$7.80	$20.85	$0.00	$61.20
4	80	$34.72	$7.80	$20.85	$0.00	$63.37
5	85	$36.89	$7.80	$20.85	$0.00	$65.54
6	90	$39.06	$7.80	$20.85	$0.00	$67.71

Effective Date - 09/16/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$26.43	$7.80	$20.85	$0.00	$55.08
2	70	$30.84	$7.80	$20.85	$0.00	$59.49
3	75	$33.04	$7.80	$20.85	$0.00	$61.69
4	80	$35.24	$7.80	$20.85	$0.00	$63.89
5	85	$37.44	$7.80	$20.85	$0.00	$66.09
6	90	$39.65	$7.80	$20.85	$0.00	$68.30

Notes:

** Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:**

JACKHAMMER & PAVING BREAKER OPERATOR *LABORERS - ZONE 1*	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35
For apprentice rates see "Apprentice- LABORER"						
LABORER *LABORERS - ZONE 1*	06/01/2016	$35.85	$7.45	$13.80	$0.00	$57.10
	12/01/2016	$36.85	$7.45	$13.80	$0.00	$58.10

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LABORER - Zone 1*

Effective Date - 06/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$21.51	$7.45	$13.80	$0.00	$42.76
2	70	$25.10	$7.45	$13.80	$0.00	$46.35
3	80	$28.68	$7.45	$13.80	$0.00	$49.93
4	90	$32.27	$7.45	$13.80	$0.00	$53.52

Effective Date - 12/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$22.11	$7.45	$13.80	$0.00	$43.36
2	70	$25.80	$7.45	$13.80	$0.00	$47.05
3	80	$29.48	$7.45	$13.80	$0.00	$50.73
4	90	$33.17	$7.45	$13.80	$0.00	$54.42

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER: CARPENTER TENDER *LABORERS - ZONE 1*	06/01/2016	$35.85	$7.45	$13.80	$0.00	$57.10
	12/01/2016	$36.85	$7.45	$13.80	$0.00	$58.10
For apprentice rates see "Apprentice- LABORER"						
LABORER: CEMENT FINISHER TENDER *LABORERS - ZONE 1*	06/01/2016	$35.85	$7.45	$13.80	$0.00	$57.10
	12/01/2016	$36.85	$7.45	$13.80	$0.00	$58.10
For apprentice rates see "Apprentice- LABORER"						
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER *LABORERS - ZONE 1*	12/01/2015	$35.50	$7.45	$13.55	$0.00	$56.50
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER *LABORERS - ZONE 1*	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35
For apprentice rates see "Apprentice- LABORER"						
LABORER: MULTI-TRADE TENDER *LABORERS - ZONE 1*	06/01/2016	$35.85	$7.45	$13.80	$0.00	$57.10
	12/01/2016	$36.85	$7.45	$13.80	$0.00	$58.10
For apprentice rates see "Apprentice- LABORER"						
LABORER: TREE REMOVER *LABORERS - ZONE 1*	06/01/2016	$35.85	$7.45	$13.80	$0.00	$57.10
	12/01/2016	$36.85	$7.45	$13.80	$0.00	$58.10
This classification applies to all tree work associated with the removal of standing trees, and trimming and removal of branches and limbs when the work is not done for a utility company for the purpose of operation, maintenance or repair of utility company equipment. For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR *LABORERS - ZONE 1*	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35
For apprentice rates see "Apprentice- LABORER"						
MARBLE & TILE FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2016	$38.78	$10.18	$17.78	$0.00	$66.74
	02/01/2017	$39.24	$10.18	$17.78	$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 - 08/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.39	$10.18	$17.78	$0.00	$47.35
2	60	$23.27	$10.18	$17.78	$0.00	$51.23
3	70	$27.15	$10.18	$17.78	$0.00	$55.11
4	80	$31.02	$10.18	$17.78	$0.00	$58.98
5	90	$34.90	$10.18	$17.78	$0.00	$62.86

Effective Date - 02/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.62	$10.18	$17.78	$0.00	$47.58
2	60	$23.54	$10.18	$17.78	$0.00	$51.50
3	70	$27.47	$10.18	$17.78	$0.00	$55.43
4	80	$31.39	$10.18	$17.78	$0.00	$59.35
5	90	$35.32	$10.18	$17.78	$0.00	$63.28

Notes:

Apprentice to Journeyworker Ratio:1:3

MARBLE MASONS,TILELAYERS & TERRAZZO MECH *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2016	$50.80	$10.18	$19.22	$0.00	$80.20
	02/01/2017	$51.37	$10.18	$19.22	$0.00	$80.77

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

Effective Date - 08/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.40	$10.18	$19.22	$0.00	$54.80
2	60	$30.48	$10.18	$19.22	$0.00	$59.88
3	70	$35.56	$10.18	$19.22	$0.00	$64.96
4	80	$40.64	$10.18	$19.22	$0.00	$70.04
5	90	$45.72	$10.18	$19.22	$0.00	$75.12

Effective Date - 02/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.69	$10.18	$19.22	$0.00	$55.09
2	60	$30.82	$10.18	$19.22	$0.00	$60.22
3	70	$35.96	$10.18	$19.22	$0.00	$65.36
4	80	$41.10	$10.18	$19.22	$0.00	$70.50
5	90	$46.23	$10.18	$19.22	$0.00	$75.63

Notes:

Apprentice to Journeyworker Ratio:1:5

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
MECH. SWEEPER OPERATOR (ON CONST. SITES)	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
OPERATING ENGINEERS LOCAL 4	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MECHANICS MAINTENANCE	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
OPERATING ENGINEERS LOCAL 4	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MILLWRIGHT (Zone 1)	04/01/2015	$37.64	$9.80	$16.21	$0.00	$63.65
MILLWRIGHTS LOCAL 1121 - Zone 1						

Apprentice - *MILLWRIGHT - Local 1121 Zone 1*

Effective Date - 04/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$20.70	$9.80	$4.48	$0.00	$34.98
2	65	$24.47	$9.80	$13.36	$0.00	$47.63
3	75	$28.23	$9.80	$14.18	$0.00	$52.21
4	85	$31.99	$9.80	$14.99	$0.00	$56.78

Notes:

Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:5

MORTAR MIXER	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
LABORERS - ZONE 1	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35
For apprentice rates see "Apprentice- LABORER"						
OILER (OTHER THAN TRUCK CRANES,GRADALLS)	06/01/2016	$22.41	$10.00	$15.15	$0.00	$47.56
OPERATING ENGINEERS LOCAL 4	12/01/2016	$23.06	$10.00	$15.15	$0.00	$48.21
	06/01/2017	$23.57	$10.00	$15.15	$0.00	$48.72
	12/01/2017	$24.09	$10.00	$15.15	$0.00	$49.24
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OILER (TRUCK CRANES, GRADALLS)	06/01/2016	$26.29	$10.00	$15.15	$0.00	$51.44
OPERATING ENGINEERS LOCAL 4	12/01/2016	$27.04	$10.00	$15.15	$0.00	$52.19
	06/01/2017	$27.64	$10.00	$15.15	$0.00	$52.79
	12/01/2017	$28.25	$10.00	$15.15	$0.00	$53.40
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OTHER POWER DRIVEN EQUIPMENT - CLASS II	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
OPERATING ENGINEERS LOCAL 4	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PAINTER (BRIDGES/TANKS)	07/01/2016	$50.46	$7.85	$16.10	$0.00	$74.41
PAINTERS LOCAL 35 - ZONE 2	01/01/2017	$51.41	$7.85	$16.10	$0.00	$75.36

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.23	$7.85	$0.00	$0.00	$33.08
2	55	$27.75	$7.85	$3.66	$0.00	$39.26
3	60	$30.28	$7.85	$3.99	$0.00	$42.12
4	65	$32.80	$7.85	$4.32	$0.00	$44.97
5	70	$35.32	$7.85	$14.11	$0.00	$57.28
6	75	$37.85	$7.85	$14.44	$0.00	$60.14
7	80	$40.37	$7.85	$14.77	$0.00	$62.99
8	90	$45.41	$7.85	$15.44	$0.00	$68.70

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.71	$7.85	$0.00	$0.00	$33.56
2	55	$28.28	$7.85	$3.66	$0.00	$39.79
3	60	$30.85	$7.85	$3.99	$0.00	$42.69
4	65	$33.42	$7.85	$4.32	$0.00	$45.59
5	70	$35.99	$7.85	$14.11	$0.00	$57.95
6	75	$38.56	$7.85	$14.44	$0.00	$60.85
7	80	$41.13	$7.85	$14.77	$0.00	$63.75
8	90	$46.27	$7.85	$15.44	$0.00	$69.56

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

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

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.68	$7.85	$0.00	$0.00	$28.53
2	55	$22.75	$7.85	$3.66	$0.00	$34.26
3	60	$24.82	$7.85	$3.99	$0.00	$36.66
4	65	$26.88	$7.85	$4.32	$0.00	$39.05
5	70	$28.95	$7.85	$14.11	$0.00	$50.91
6	75	$31.02	$7.85	$14.44	$0.00	$53.31
7	80	$33.09	$7.85	$14.77	$0.00	$55.71
8	90	$37.22	$7.85	$15.44	$0.00	$60.51

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.16	$7.85	$0.00	$0.00	$29.01
2	55	$23.27	$7.85	$3.66	$0.00	$34.78
3	60	$25.39	$7.85	$3.99	$0.00	$37.23
4	65	$27.50	$7.85	$4.32	$0.00	$39.67
5	70	$29.62	$7.85	$14.11	$0.00	$51.58
6	75	$31.73	$7.85	$14.44	$0.00	$54.02
7	80	$33.85	$7.85	$14.77	$0.00	$56.47
8	90	$38.08	$7.85	$15.44	$0.00	$61.37

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	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 - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.71	$7.85	$0.00	$0.00	$27.56
2	55	$21.68	$7.85	$3.66	$0.00	$33.19
3	60	$23.65	$7.85	$3.99	$0.00	$35.49
4	65	$25.62	$7.85	$4.32	$0.00	$37.79
5	70	$27.59	$7.85	$14.11	$0.00	$49.55
6	75	$29.57	$7.85	$14.44	$0.00	$51.86
7	80	$31.54	$7.85	$14.77	$0.00	$54.16
8	90	$35.48	$7.85	$15.44	$0.00	$58.77

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.19	$7.85	$0.00	$0.00	$28.04
2	55	$22.20	$7.85	$3.66	$0.00	$33.71
3	60	$24.22	$7.85	$3.99	$0.00	$36.06
4	65	$26.24	$7.85	$4.32	$0.00	$38.41
5	70	$28.26	$7.85	$14.11	$0.00	$50.22
6	75	$30.28	$7.85	$14.44	$0.00	$52.57
7	80	$32.30	$7.85	$14.77	$0.00	$54.92
8	90	$36.33	$7.85	$15.44	$0.00	$59.62

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (TRAFFIC MARKINGS) *LABORERS - ZONE 1*	06/01/2016	$35.85	$7.45	$13.80	$0.00	$57.10
For Apprentice rates see "Apprentice- LABORER"	12/01/2016	$36.85	$7.45	$13.80	$0.00	$58.10
PAINTER / TAPER (BRUSH, NEW) *	07/01/2016	$39.96	$7.85	$16.10	$0.00	$63.91
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	01/01/2017	$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 - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.98	$7.85	$0.00	$0.00	$27.83
2	55	$21.98	$7.85	$3.66	$0.00	$33.49
3	60	$23.98	$7.85	$3.99	$0.00	$35.82
4	65	$25.97	$7.85	$4.32	$0.00	$38.14
5	70	$27.97	$7.85	$14.11	$0.00	$49.93
6	75	$29.97	$7.85	$14.44	$0.00	$52.26
7	80	$31.97	$7.85	$14.77	$0.00	$54.59
8	90	$35.96	$7.85	$15.44	$0.00	$59.25

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.46	$7.85	$0.00	$0.00	$28.31
2	55	$22.50	$7.85	$3.66	$0.00	$34.01
3	60	$24.55	$7.85	$3.99	$0.00	$36.39
4	65	$26.59	$7.85	$4.32	$0.00	$38.76
5	70	$28.64	$7.85	$14.11	$0.00	$50.60
6	75	$30.68	$7.85	$14.44	$0.00	$52.97
7	80	$32.73	$7.85	$14.77	$0.00	$55.35
8	90	$36.82	$7.85	$15.44	$0.00	$60.11

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT)	07/01/2016	$38.02	$7.85	$16.10	$0.00	$61.97
PAINTERS LOCAL 35 - ZONE 2	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 - 07/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.01	$7.85	$0.00	$0.00	$26.86
2	55	$20.91	$7.85	$3.66	$0.00	$32.42
3	60	$22.81	$7.85	$3.99	$0.00	$34.65
4	65	$24.71	$7.85	$4.32	$0.00	$36.88
5	70	$26.61	$7.85	$14.11	$0.00	$48.57
6	75	$28.52	$7.85	$14.44	$0.00	$50.81
7	80	$30.42	$7.85	$14.77	$0.00	$53.04
8	90	$34.22	$7.85	$15.44	$0.00	$57.51

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.49	$7.85	$0.00	$0.00	$27.34
2	55	$21.43	$7.85	$3.66	$0.00	$32.94
3	60	$23.38	$7.85	$3.99	$0.00	$35.22
4	65	$25.33	$7.85	$4.32	$0.00	$37.50
5	70	$27.28	$7.85	$14.11	$0.00	$49.24
6	75	$29.23	$7.85	$14.44	$0.00	$51.52
7	80	$31.18	$7.85	$14.77	$0.00	$53.80
8	90	$35.07	$7.85	$15.44	$0.00	$58.36

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PANEL & PICKUP TRUCKS DRIVER *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	08/01/2016	$33.08	$10.91	$10.08	$0.00	$54.07
	12/01/2016	$33.08	$10.91	$10.89	$0.00	$54.88
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2015	$42.04	$9.80	$19.23	$0.00	$71.07
PILE DRIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2015	$42.04	$9.80	$19.23	$0.00	$71.07

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PILE DRIVER - Local 56 Zone 1*

Effective Date - 08/01/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.02	$9.80	$19.23	$0.00	$50.05
2	60	$25.22	$9.80	$19.23	$0.00	$54.25
3	70	$29.43	$9.80	$19.23	$0.00	$58.46
4	75	$31.53	$9.80	$19.23	$0.00	$60.56
5	80	$33.63	$9.80	$19.23	$0.00	$62.66
6	80	$33.63	$9.80	$19.23	$0.00	$62.66
7	90	$37.84	$9.80	$19.23	$0.00	$66.87
8	90	$37.84	$9.80	$19.23	$0.00	$66.87

Notes:

Apprentice to Journeyworker Ratio:1:3

PIPEFITTER & STEAMFITTER *PIPEFITTERS LOCAL 537*	03/01/2016	$49.19	$9.70	$18.14	$0.00	$77.03
	09/01/2016	$50.19	$9.70	$18.14	$0.00	$78.03
	03/01/2017	$51.19	$9.70	$18.14	$0.00	$79.03

Apprentice - *PIPEFITTER - Local 537*

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$19.68	$9.70	$7.50	$0.00	$36.88
2	45	$22.14	$9.70	$18.14	$0.00	$49.98
3	60	$29.51	$9.70	$18.14	$0.00	$57.35
4	70	$34.43	$9.70	$18.14	$0.00	$62.27
5	80	$39.35	$9.70	$18.14	$0.00	$67.19

Effective Date - 09/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$20.08	$9.70	$7.50	$0.00	$37.28
2	45	$22.59	$9.70	$18.14	$0.00	$50.43
3	60	$30.11	$9.70	$18.14	$0.00	$57.95
4	70	$35.13	$9.70	$18.14	$0.00	$62.97
5	80	$40.15	$9.70	$18.14	$0.00	$67.99

Notes:
** 1:3; 3:15; 1:10 thereafter / Steps are 1 yr.
Refrig/AC Mechanic **1:1;1:2;2:4;3:6;4:8;5:10;6:12;7:14;8:17;9:20;10:23(Max)

Apprentice to Journeyworker Ratio:**

PIPELAYER *LABORERS - ZONE 1*	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PLUMBERS & GASFITTERS *PLUMBERS & GASFITTERS LOCAL 12*	03/01/2016	$51.36	$11.07	$15.14	$0.00	$77.57
	09/01/2016	$52.41	$11.07	$15.14	$0.00	$78.62
	03/01/2017	$53.41	$11.07	$15.14	$0.00	$79.62

Apprentice - *PLUMBER/GASFITTER - Local 12*

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$17.98	$11.07	$5.63	$0.00	$34.68
2	40	$20.54	$11.07	$6.37	$0.00	$37.98
3	55	$28.25	$11.07	$8.56	$0.00	$47.88
4	65	$33.38	$11.07	$10.03	$0.00	$54.48
5	75	$38.52	$11.07	$11.48	$0.00	$61.07

Effective Date - 09/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$18.34	$11.07	$5.63	$0.00	$35.04
2	40	$20.96	$11.07	$6.36	$0.00	$38.39
3	55	$28.83	$11.07	$8.55	$0.00	$48.45
4	65	$34.07	$11.07	$10.02	$0.00	$55.16
5	75	$39.31	$11.07	$11.48	$0.00	$61.86

Notes:
** 1:2; 2:6; 3:10; 4:14; 5:19/Steps are 1 yr
Step4 with lic$57.78 Step5 with lic$64.37

Apprentice to Journeyworker Ratio:**

PNEUMATIC CONTROLS (TEMP.) *PIPEFITTERS LOCAL 537*	03/01/2016	$49.19	$9.70	$18.14	$0.00	$77.03
	09/01/2016	$50.19	$9.70	$18.14	$0.00	$78.03
	03/01/2017	$51.19	$9.70	$18.14	$0.00	$79.03
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
PNEUMATIC DRILL/TOOL OPERATOR *LABORERS - ZONE 1*	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35
For apprentice rates see "Apprentice- LABORER"						
POWDERMAN & BLASTER *LABORERS - ZONE 1*	06/01/2016	$36.85	$7.45	$13.80	$0.00	$58.10
	12/01/2016	$37.85	$7.45	$13.80	$0.00	$59.10
For apprentice rates see "Apprentice- LABORER"						
POWER SHOVEL/DERRICK/TRENCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (CONCRETE) *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PUMP OPERATOR (DEWATERING, OTHER) *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$30.40	$10.00	$15.15	$0.00	$55.55
	12/01/2016	$31.27	$10.00	$15.15	$0.00	$56.42
	06/01/2017	$31.96	$10.00	$15.15	$0.00	$57.11
	12/01/2017	$32.65	$10.00	$15.15	$0.00	$57.80
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY MIX CONCRETE DRIVERS after 4/30/10 (Drivers Hired After 4/30/2010) *TEAMSTERS LOCAL 25b*	07/01/2016	$28.03	$8.23	$9.31	$0.00	$45.57
	05/01/2017	$28.18	$8.23	$9.72	$0.00	$46.13
	07/01/2017	$28.18	$8.48	$9.72	$0.00	$46.38
READY-MIX CONCRETE DRIVER *TEAMSTERS LOCAL 25b*	07/01/2016	$29.33	$8.23	$9.31	$0.00	$46.87
	05/01/2017	$29.48	$8.23	$9.72	$0.00	$47.43
	07/01/2017	$29.48	$8.48	$9.72	$0.00	$47.68
RECLAIMERS *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
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.

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 1*	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ROLLER/SPREADER/MULCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
ROOFER (Inc.Roofer Waterproofing &Roofer Damproofg) *ROOFERS LOCAL 33*	08/01/2016	$41.11	$11.00	$13.00	$0.00	$65.11
	02/01/2017	$42.26	$11.00	$13.00	$0.00	$66.26
	08/01/2017	$43.36	$11.00	$13.00	$0.00	$67.36
	02/01/2018	$44.51	$11.00	$13.00	$0.00	$68.51
	08/01/2018	$45.61	$11.00	$13.00	$0.00	$69.61
	02/01/2019	$46.76	$11.00	$13.00	$0.00	$70.76

Apprentice - *ROOFER - Local 33*

Effective Date - 08/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.56	$11.00	$3.44	$0.00	$35.00
2	60	$24.67	$11.00	$13.00	$0.00	$48.67
3	65	$26.72	$11.00	$13.00	$0.00	$50.72
4	75	$30.83	$11.00	$13.00	$0.00	$54.83
5	85	$34.94	$11.00	$13.00	$0.00	$58.94

Effective Date - 02/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.13	$11.00	$3.44	$0.00	$35.57
2	60	$25.36	$11.00	$13.00	$0.00	$49.36
3	65	$27.47	$11.00	$13.00	$0.00	$51.47
4	75	$31.70	$11.00	$13.00	$0.00	$55.70
5	85	$35.92	$11.00	$13.00	$0.00	$59.92

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*	08/01/2016	$41.36	$11.00	$13.00	$0.00	$65.36
	02/01/2017	$42.51	$11.00	$13.00	$0.00	$66.51
	08/01/2017	$43.61	$11.00	$13.00	$0.00	$67.61
	02/01/2018	$44.76	$11.00	$13.00	$0.00	$68.76
	08/01/2018	$45.86	$11.00	$13.00	$0.00	$69.86
	02/01/2019	$47.01	$11.00	$13.00	$0.00	$71.01
For apprentice rates see "Apprentice- ROOFER"						
SHEETMETAL WORKER *SHEETMETAL WORKERS LOCAL 17 - A*	08/01/2016	$43.31	$10.70	$23.07	$2.31	$79.39
	02/01/2017	$44.41	$10.70	$23.07	$2.31	$80.49
	08/01/2017	$45.51	$10.70	$23.07	$2.31	$81.59
	02/01/2018	$46.66	$10.70	$23.07	$2.31	$82.74

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 08/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$17.32	$10.70	$5.24	$0.00	$33.26
2	40	$17.32	$10.70	$5.24	$0.00	$33.26
3	45	$19.49	$10.70	$10.31	$1.21	$41.71
4	45	$19.49	$10.70	$10.31	$1.21	$41.71
5	50	$21.66	$10.70	$11.21	$1.31	$44.88
6	50	$21.66	$10.70	$11.46	$1.31	$45.13
7	60	$25.99	$10.70	$13.02	$1.49	$51.20
8	65	$28.15	$10.70	$13.93	$1.58	$54.36
9	75	$32.48	$10.70	$15.74	$1.77	$60.69
10	85	$36.81	$10.70	$17.05	$1.94	$66.50

Effective Date - 02/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$17.76	$10.70	$5.24	$0.00	$33.70
2	40	$17.76	$10.70	$5.24	$0.00	$33.70
3	45	$19.98	$10.70	$10.31	$1.23	$42.22
4	45	$19.98	$10.70	$10.31	$1.23	$42.22
5	50	$22.21	$10.70	$11.21	$1.32	$45.44
6	50	$22.21	$10.70	$11.46	$1.33	$45.70
7	60	$26.65	$10.70	$13.02	$1.51	$51.88
8	65	$28.87	$10.70	$13.93	$1.61	$55.11
9	75	$33.31	$10.70	$15.74	$1.79	$61.54
10	85	$37.75	$10.70	$17.05	$1.97	$67.47

Notes:
Steps are 6 mos.

Apprentice to Journeyworker Ratio:1:4

SIGN ERECTOR	06/01/2013	$25.81	$7.07	$7.05	$0.00	$39.93

PAINTERS LOCAL 35 - ZONE 2

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 A*	08/01/2016	$33.54	$10.91	$10.08	$0.00	$54.53
	12/01/2016	$33.54	$10.91	$10.89	$0.00	$55.34
SPECIALIZED EARTH MOVING EQUIP > 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	08/01/2016	$33.83	$10.91	$10.08	$0.00	$54.82
	12/01/2016	$33.83	$10.91	$10.89	$0.00	$55.63
SPRINKLER FITTER *SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1*	03/01/2016	$54.43	$8.67	$16.80	$0.00	$79.90
	10/01/2016	$55.53	$8.67	$16.80	$0.00	$81.00
	03/01/2017	$56.53	$8.67	$16.80	$0.00	$82.00

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$19.05	$8.67	$8.55	$0.00	$36.27
2	40	$21.77	$8.67	$8.55	$0.00	$38.99
3	45	$24.49	$8.67	$8.55	$0.00	$41.71
4	50	$27.22	$8.67	$8.55	$0.00	$44.44
5	55	$29.94	$8.67	$8.55	$0.00	$47.16
6	60	$32.66	$8.67	$8.55	$0.00	$49.88
7	65	$35.38	$8.67	$8.55	$0.00	$52.60
8	70	$38.10	$8.67	$8.55	$0.00	$55.32
9	75	$40.82	$8.67	$8.55	$0.00	$58.04
10	80	$43.54	$8.67	$8.55	$0.00	$60.76

Effective Date - 10/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$19.44	$8.67	$8.55	$0.00	$36.66
2	40	$22.21	$8.67	$8.55	$0.00	$39.43
3	45	$24.99	$8.67	$8.55	$0.00	$42.21
4	50	$27.77	$8.67	$8.55	$0.00	$44.99
5	55	$30.54	$8.67	$8.55	$0.00	$47.76
6	60	$33.32	$8.67	$8.55	$0.00	$50.54
7	65	$36.09	$8.67	$8.55	$0.00	$53.31
8	70	$38.87	$8.67	$8.55	$0.00	$56.09
9	75	$41.65	$8.67	$8.55	$0.00	$58.87
10	80	$44.42	$8.67	$8.55	$0.00	$61.64

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*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TELECOMMUNICATION TECHNICIAN *ELECTRICIANS LOCAL 103*	03/01/2016	$34.63	$13.00	$14.55	$0.00	$62.18

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *TELECOMMUNICATION TECHNICIAN - Local 103*

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$13.85	$13.00	$0.42	$0.00	$27.27
2	40	$13.85	$13.00	$0.42	$0.00	$27.27
3	45	$15.58	$13.00	$11.52	$0.00	$40.10
4	45	$15.58	$13.00	$11.52	$0.00	$40.10
5	50	$17.32	$13.00	$11.79	$0.00	$42.11
6	55	$19.05	$13.00	$12.06	$0.00	$44.11
7	60	$20.78	$13.00	$12.34	$0.00	$46.12
8	65	$22.51	$13.00	$12.62	$0.00	$48.13
9	70	$24.24	$13.00	$12.90	$0.00	$50.14
10	75	$25.97	$13.00	$13.17	$0.00	$52.14

Notes:

Apprentice to Journeyworker Ratio:1:1

TERRAZZO FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2016	$49.70	$10.18	$19.22	$0.00	$79.10
	02/01/2017	$50.27	$10.18	$19.22	$0.00	$79.67

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

Effective Date - 08/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.85	$10.18	$19.22	$0.00	$54.25
2	60	$29.82	$10.18	$19.22	$0.00	$59.22
3	70	$34.79	$10.18	$19.22	$0.00	$64.19
4	80	$39.76	$10.18	$19.22	$0.00	$69.16
5	90	$44.73	$10.18	$19.22	$0.00	$74.13

Effective Date - 02/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.14	$10.18	$19.22	$0.00	$54.54
2	60	$30.16	$10.18	$19.22	$0.00	$59.56
3	70	$35.19	$10.18	$19.22	$0.00	$64.59
4	80	$40.22	$10.18	$19.22	$0.00	$69.62
5	90	$45.24	$10.18	$19.22	$0.00	$74.64

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER *LABORERS - FOUNDATION AND MARINE*	06/01/2016	$37.20	$7.45	$14.00	$0.00	$58.65
	12/01/2016	$38.20	$7.45	$14.00	$0.00	$59.65

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TEST BORING DRILLER HELPER *LABORERS - FOUNDATION AND MARINE*	06/01/2016	$35.92	$7.45	$14.00	$0.00	$57.37
	12/01/2016	$36.92	$7.45	$14.00	$0.00	$58.37
For apprentice rates see "Apprentice- LABORER"						
TEST BORING LABORER *LABORERS - FOUNDATION AND MARINE*	06/01/2016	$35.80	$7.45	$14.00	$0.00	$57.25
	12/01/2016	$36.80	$7.45	$14.00	$0.00	$58.25
For apprentice rates see "Apprentice- LABORER"						
TRACTORS/PORTABLE STEAM GENERATORS *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$43.81	$10.00	$15.15	$0.00	$68.96
	12/01/2016	$45.04	$10.00	$15.15	$0.00	$70.19
	06/01/2017	$46.03	$10.00	$15.15	$0.00	$71.18
	12/01/2017	$47.02	$10.00	$15.15	$0.00	$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	08/01/2016	$34.12	$10.91	$10.08	$0.00	$55.11
	12/01/2016	$34.12	$10.91	$10.89	$0.00	$55.92
TUNNEL WORK - COMPRESSED AIR *LABORERS (COMPRESSED AIR)*	06/01/2016	$48.08	$7.45	$14.40	$0.00	$69.93
	12/01/2016	$49.08	$7.45	$14.40	$0.00	$70.93
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) *LABORERS (COMPRESSED AIR)*	06/01/2016	$50.08	$7.45	$14.40	$0.00	$71.93
	12/01/2016	$51.08	$7.45	$14.40	$0.00	$72.93
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR *LABORERS (FREE AIR TUNNEL)*	06/01/2016	$40.15	$7.45	$14.40	$0.00	$62.00
	12/01/2016	$41.15	$7.45	$14.40	$0.00	$63.00
For apprentice rates see "Apprentice- LABORER".						
TUNNEL WORK - FREE AIR (HAZ. WASTE) *LABORERS (FREE AIR TUNNEL)*	06/01/2016	$42.15	$7.45	$14.40	$0.00	$64.00
	12/01/2016	$43.15	$7.45	$14.40	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL *TEAMSTERS JOINT COUNCIL NO. 10 ZONE A*	08/01/2016	$33.54	$10.91	$10.08	$0.00	$54.53
	12/01/2016	$33.54	$10.91	$10.89	$0.00	$55.34
WAGON DRILL OPERATOR *LABORERS - ZONE 1*	06/01/2016	$36.10	$7.45	$13.80	$0.00	$57.35
	12/01/2016	$37.10	$7.45	$13.80	$0.00	$58.35
For apprentice rates see "Apprentice- LABORER"						
WASTE WATER PUMP OPERATOR *OPERATING ENGINEERS LOCAL 4*	06/01/2016	$44.23	$10.00	$15.15	$0.00	$69.38
	12/01/2016	$45.48	$10.00	$15.15	$0.00	$70.63
	06/01/2017	$46.48	$10.00	$15.15	$0.00	$71.63
	12/01/2017	$47.48	$10.00	$15.15	$0.00	$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER *PLUMBERS & GASFITTERS LOCAL 12*	03/01/2016	$51.36	$11.07	$15.14	$0.00	$77.57
	09/01/2016	$52.41	$11.07	$15.14	$0.00	$78.62
	03/01/2017	$53.41	$11.07	$15.14	$0.00	$79.62
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$26.11	$7.25	$1.78	$0.00	$35.14
	08/28/2016	$26.61	$7.50	$1.80	$0.00	$35.91
	09/03/2017	$27.14	$7.75	$1.81	$0.00	$36.70
For apprentice rates see "Apprentice- LINEMAN"						
CABLEMAN (Underground Ducts & Cables) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$36.98	$7.25	$8.12	$0.00	$52.35
	08/28/2016	$37.70	$7.50	$8.87	$0.00	$54.07
	09/03/2017	$38.45	$7.75	$9.53	$0.00	$55.73
For apprentice rates see "Apprentice- LINEMAN"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DRIVER / GROUNDMAN CDL *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$30.46	$7.25	$8.34	$0.00	$46.05
	08/28/2016	$31.05	$7.50	$8.89	$0.00	$47.44
	09/03/2017	$31.66	$7.75	$9.44	$0.00	$48.85
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$23.93	$7.25	$1.72	$0.00	$32.90
	08/28/2016	$24.39	$7.50	$1.73	$0.00	$33.62
	09/03/2017	$24.88	$7.75	$1.75	$0.00	$34.38
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class A CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$36.98	$7.25	$12.29	$0.00	$56.52
	08/28/2016	$37.70	$7.50	$12.95	$0.00	$58.15
	09/03/2017	$38.45	$7.75	$13.61	$0.00	$59.81
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class B CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$32.63	$7.25	$9.05	$0.00	$48.93
	08/28/2016	$33.26	$7.50	$9.63	$0.00	$50.39
	09/03/2017	$33.92	$7.75	$10.21	$0.00	$51.88
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$23.93	$7.25	$1.72	$0.00	$32.90
	08/28/2016	$24.39	$7.50	$1.73	$0.00	$33.62
	09/03/2017	$24.88	$7.75	$1.75	$0.00	$34.38
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN -Inexperienced (<2000 Hrs.) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$19.58	$7.25	$1.59	$0.00	$28.42
	08/28/2016	$19.96	$7.50	$1.60	$0.00	$29.06
	09/03/2017	$20.35	$7.75	$1.61	$0.00	$29.71
For apprentice rates see "Apprentice- LINEMAN"						
JOURNEYMAN LINEMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	08/30/2015	$43.51	$7.25	$15.06	$0.00	$65.82
	08/28/2016	$44.35	$7.50	$15.83	$0.00	$67.68
	09/03/2017	$45.23	$7.75	$16.61	$0.00	$69.59

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 08/30/2015

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$26.11	$7.25	$3.28	$0.00	$36.64
2	65	$28.28	$7.25	$3.35	$0.00	$38.88
3	70	$30.46	$7.25	$3.41	$0.00	$41.12
4	75	$32.63	$7.25	$4.98	$0.00	$44.86
5	80	$34.81	$7.25	$5.04	$0.00	$47.10
6	85	$36.98	$7.25	$5.11	$0.00	$49.34
7	90	$39.16	$7.25	$7.17	$0.00	$53.58

Effective Date - 08/28/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$26.61	$7.50	$3.30	$0.00	$37.41
2	65	$28.83	$7.50	$3.36	$0.00	$39.69
3	70	$31.05	$7.50	$3.43	$0.00	$41.98
4	75	$33.26	$7.50	$5.00	$0.00	$45.76
5	80	$35.48	$7.50	$5.06	$0.00	$48.04
6	85	$37.70	$7.50	$5.13	$0.00	$50.33
7	90	$39.92	$7.50	$7.20	$0.00	$54.62

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/01/2016	$28.98	$4.25	$3.12	$0.00	$36.35
TELEDATA LINEMAN/EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/01/2016	$27.31	$4.25	$3.07	$0.00	$34.63
TELEDATA WIREMAN/INSTALLER/TECHNICIAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/01/2016	$27.31	$4.25	$3.07	$0.00	$34.63
TREE TRIMMER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	01/31/2016	$18.51	$3.55	$0.00	$0.00	$22.06

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

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

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.

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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.

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 be updated for any public construction project lasting longer than one (1) year.
- '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, and any updated 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

WEEKLY PAYROLL RECORDS REPORT
& STATEMENT OF COMPLIANCE

In accordance with Massachusetts General Law c149, §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. This is required to be done on a weekly basis. 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 Department of Labor & Workforce Development/Division of Occupational Safety 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

_____, 2016

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, 399 WASHINGTON STREET, 5TH FL., BOSTON, MA. 02108

WEEKLY PAYROLL REPORT FORM

Company Name:

Project Name:

Awarding Auth.:

Work Week Ending:

Prime Contractor

Subcontractor
List Prime Contractor:

Employer Signature:

Print Name & Title:

Employee Name & Address	Work Classification	Hours Worked							(A) Tot. Hrs.	(B) Hourly Base Wage	Employer Contributions			(F) [B+C+D+E] Hourly Total Wage (prev. wage)	(G) [A*F] Weekly Total Amount
											(C) Health & Welfare	(D) Pension	(E) Supp. Unemp		
		S	M	T	W	T	F	S							

NOTE: Every contractor and subcontractor is required to submit a copy of their weekly payroll records to the awarding authority.

CONTRACTOR'S SPECIFICATIONS ARE LOCATED IN A SEPARATE FILE.

DRAWINGS MAY BE OBTAINED THROUGH THE PURCHASING DEPARTMENT

(Call to ensure availability 617-796-1220)

(6 PAGES)

END OF SECTION

Newton Highlands Playground | Technical Specifications

Table of Contents

00890	Permits
01110	Control of Work and Materials
01330	Submittals
01450	Sampling & Testing
01451	Structural Tests and Inspections
01562	Dust Control
01570	Environmental Protection
01575	Handling Existing Flows
01720	Construction Layout
01740	Cleaning Up
01770	Project Closeout
02051	Asbestos Abatement
02071	Geotextile Fabrics
02085	Polyvinyl Chloride Gravity Pipe and Fittings
02220	Demolition
02230	Clearing and Grubbing
02232	Selective Clearing, Pruning, and Invasive Species Removal
02240	Dewatering
02252	Support of Excavation
02290	Seeding
02300	Earthwork
02515	Service Connections (Water Service)
02516	Connections to Existing Water Mains
02533	Connections to Existing Structures
02625	Drainage Pipe
02630	Drainage Structures
02631	Precast Manholes and Catch Basins
02632	Adjustment of Structures
02635	Stormwater Treatment System
02730	Accessible Trail Surfacing
02755	Bituminous Concrete Pavement and Color Sealcoat
02760	Pavement Markings
02773	Curbing
02782	Concrete Pavers
02800	Site Furnishings
02810	Irrigation System
02811	Irrigation Well Pump System
02820	Black Vinyl Clad Chain Link Fence and Gates
02822	Ballfield Backstop
02886	Play Equipment
02887	Rubber Safety Surfacing
02910	Screened Loam Borrow and Topsoil Re-used
02911	Root Zone Mix Preparation & Blecavation
02920	Sodding
02930	Trees, Shrubs, Groundcovers, and Landscaping
03100	Concrete Formwork
03200	Concrete Reinforcement
03301	Cast-in-Place Concrete
03320	Reinforced Cement Concrete Mow Strip
04050	Fieldstone Wall and Entrance Piers
05000	Miscellaneous Metals
13382	Lead Based Coatings Removal

16010 Electrical Work – General Provisions
16050 Basic Electrical Materials and Methods
16123 Conductors and Cables
16130 Raceways and Boxes
16442 Panelboards
16526 Sports Lighting

Appendices

Appendix A- Order of Conditions
Appendix B- Existing Building Environmental Hazards Assessment
Appendix C- Boring Logs and Test Pits
Appendix D- Field Preparation and Soil Amendments Guidance
Appendix E- Play Manufacturer Specifications and Details
Appendix F- Sports Lighting Manufacturer Specifications and Details

SECTION 00890

PERMITS

PART 1 – GENERAL

1.01 DESCRIPTION:

This Section provides specific information and defines specific requirements of the Contractor regarding the preparation and acquisition of permits required to perform the work of this project.

1.02 RELATED WORK:

A. Section 01110, CONTROL OF WORK AND MATERIALS

B. Section 01562, DUST CONTROL

C. Section 01570, ENVIRONMENTAL PROTECTION

D. Section 02220, DEMOLITION

E. Section 02240, DEWATERING

F. Section 02222, UTILITY ABANDONMENT

G. Section 02300, EARTHWORK

H. Section 16000, ELECTRICAL

1.03 GENERAL REQUIREMENTS:

A. The Owner has obtained or will obtain and pay for the permits listed below, which are required for this project. The Contractor shall assist in obtaining certain permits, as indicated. The Contractor shall obtain and pay for all other permits required, as defined under this section.

Permits	Status
Conservation Commission Order of Conditions (Ch. 131, s. 40)	(Attached)
Trench Permit (520 CMR 14.00)(eff. date 3/1/09)	*
NPDES Construction General Permit	*
General Building Permit (780 CMR Section 105)	*
Plumbing Permit	*
Electrical Permit	*
Occupancy Permit	*

*Contractor shall prepare permit application and obtain the permit after contract is awarded, bearing all expenses. Owner will waive the permit application fee, if possible.

1.04 CONSERVATION COMMISSION ORDERS:

The Conservation Commission has under the authority of Massachusetts General Laws Chapter 131, Section 40, and under the Newton City Ordinance, Article 2, Section 22-19 issued an Order of Conditions on the work under this contract. This Order is to become a part of the Contract Documents and the Contractor shall perform all work in strict conformance with said Order. A copy of this Order is attached to the Appendix.

PART 2 - PRODUCTS

Not Used.

PART 3 – EXECUTION

3.01 PERFORM WORK IN ACCORDANCE WITH REQUIREMENTS:

A. The Contractor shall perform the work in accordance with the Contract Documents, including the attached permits/order of conditions, and any applicable municipal requirements.

B. Prior to commencing any construction activities, the Contractor shall demonstrate to the Owner and the Engineer, through on-site inspection and submitting copies of permits or

approvals, that it is in full compliance with the terms and conditions of all permits specified herein. The Contractor shall maintain full compliance with all permits throughout the performance of the work, and upon request, grant access to permitting authorities to inspect the site for the purpose of verifying such compliance.

END OF SECTION

SECTION 01110

CONTROL OF WORK AND MATERIALS

PART I - GENERAL

1.01 SCOPE OF WORK:

1. Hauling, Handling and Storage of Materials
2. Open Excavations
3. Maintenance of Traffic
4. Care and Protection of Property
5. Protection and Relocation of Existing Structures and Utilities
6. Maintenance of Flow
7. Rejected Materials and Defective Work
8. Sanitary Regulations
9. Safety and Health Regulations
10. Site Investigation
11. Weather Protection
12. Hazardous Waste

PART II - MATERIALS

N/A

PART III - EXECUTION

3.01 HAULING, HANDLING AND STORAGE OF MATERIALS:

A. The Contractor shall, at his own expense, handle and haul all materials furnished by him and shall remove any of his surplus materials at the completion of the work.

B. The Contractor shall provide suitable and adequate storage for equipment and materials furnished by him that are liable to injury and shall be responsible for any loss of or damage to any equipment or materials by theft, breakage, or otherwise.

C. All excavated materials and equipment to be incorporated in the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work. Materials and equipment shall be kept neatly piled and compactly stored in such location as will cause a minimum of inconvenience to public travel and adjoining owners, tenants and occupants.

D. The Contractor shall be responsible for all damages to the work under construction during its progress and until final completion and acceptance even though partial payments have been made under the Contract.

3.02 OPEN EXCAVATIONS:

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and safe means for completely covering all open excavations if applicable.

3.03 MAINTENANCE OF TRAFFIC:

A. Construction traffic and operations shall be conducted so that vehicular and pedestrian traffic may be safely maintained at all times.

B. Should the Chief of Police deem it necessary, uniformed officers will be assigned to direct traffic. The Contractor shall make all arrangements in obtaining uniformed officers required.

C. The Contractor shall at his own expense, as directed by the Police Traffic Control/Safety Officer, provide and erect acceptable barricades, barrier fences, traffic signs, and all other traffic devices not specifically covered in a bid item, to protect the work from traffic, pedestrians, and animals. He shall provide sufficient temporary lighting such as lanterns/flashers (electric battery operated) or other approved illuminated traffic signs and devices to afford adequate protection to the traveling public, at no additional cost to the Owner.

D. The Contractor shall furnish all construction signs that are deemed necessary by and in accordance with Part VI of the Manual on Uniform Traffic Control Devices as published by the U.S. Department of Transportation. In addition, the Contractor may be required to furnish up to 128 square feet of additional special construction warning signs. Size and exact wording of signs shall be determined by the Engineer during construction.

E. The intent of policing is to ensure public safety by direction of traffic. Police officers are not to serve as watchmen to protect the Contractor's equipment and materials.

F. Nothing contained herein shall be construed as relieving the Contractor of any of his responsibilities for protection of persons and property under the terms of the Contract.

3.04 CARE AND PROTECTION OF PROPERTY:

The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be promptly restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, to the satisfaction of the Engineer.

3.05 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES:

A. All existing buildings, utilities, pipes, poles, wires fences, curbing, property line markers and other structures which the Engineer decides must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage by the contractor. Should such property be damaged, it shall be restored by the Contractor, at no additional cost to the Owner.

B. The Contractor shall determine the location of all underground structures and utilities (including existing water services, drain lines, electrical lines, and sewers).

C. On paved surfaces the Contractor shall not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels which are shaped so as to cut or otherwise damage such surfaces.

D. All property damaged by the Contractor's operations shall be restored to a condition at least equal to that in which it was found immediately before work was begun. Suitable materials and methods shall be used for such restoration.

E. Restoration of existing property and structures shall be carried out as promptly as practicable and shall not be left until the end of the construction period.

3.06 MAINTENANCE OF FLOW:

A. All existing drainage facilities including, but not limited to; brooks, streams, canals, channels, ditches, culverts, catch basins and drainage piping shall be adequately safeguarded so as not to impede drainage or to cause siltation of downstream areas in any manner whatsoever. If the Contractor damages or impairs any of the aforesaid drainage facilities, he shall repair the same within the same day.

B. At the conclusion of the work and following approval by the local Conservation Agent, the Contractor shall remove all Erosion and Sedimentation controls as well as trapped sediments as described in Section 01740, CLEANING UP.

3.07 REJECTED MATERIALS AND DEFECTIVE WORK:

A. Materials furnished by the Contractor and condemned by the Engineer as unsuitable or not in conformity with the specifications shall forthwith be removed from the work by the Contractor, and shall not be made use of elsewhere in the work.

B. Any errors, defects or omissions in the execution of the work or in the materials furnished by the Contractor, even though they may have been passed or overlooked or have appeared after the completion of the work, discovered at any time before the final payment is made hereunder, shall be forthwith rectified and made good by and at the expense of the Contractor and in a manner satisfactory to the Engineer.

C. The Contractor shall reimburse the Owner for any expense, losses or damages

incurred in consequence of any defect, error, omission or act of the Contractor or his employees, as determined by the Engineer, occurring previous to the final payment.

3.08 SANITARY REGULATIONS:

Sanitary conveniences for the use of all persons employed on the work, properly screened from public observation, shall be provided in sufficient numbers in such manner and at such locations as may be approved. The contents shall be removed and disposed of in a satisfactory manner as the occasion requires. The Contractor shall rigorously prohibit the committing of nuisances within, on or about the work. Any employees found violating these provisions shall be discharged and not again employed on the work without the written consent of the Engineer. The sanitary conveniences specified above shall be the obligation and responsibility of the Contractor.

3.09 SAFETY AND HEALTH REGULATIONS:

This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction Operations (454 CMR 10.0 et. seq.)." Contractors shall be familiar with the requirements of these regulations.

3.10 SITE INVESTIGATION:

The Contractor acknowledges that he has satisfied himself as to the conditions existing at the site of the work, the type of equipment required to perform this work, the quality and quantity of the materials furnished insofar as this information is reasonably ascertainable from an inspection of the site, as well as from information presented by the drawings and specifications made a part of this contract. Any failure of the Contractor to acquaint himself with available information will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work. The Owner assumes no responsibility for any conclusion or interpretation made by the Contractor on the basis of the information made available by the Owner.

3.11 WEATHER PROTECTION:

In conformance with Sections 44F and 44G of Chapter 149 of the General Laws of Massachusetts, the General Contractor shall install weather protection and shall furnish adequate heat in the area so protected during the months of November through March. Standards for such specifications shall be established by the Director of Building Construction in the Executive Office for Administration and Finance.

3.12 HAZARDOUS WASTE:

Should the Contractor, while performing work under this contract, uncover hazardous materials, as defined in Massachusetts Hazardous Waste Regulations 310 CMR 30.00, he shall immediately notify the Engineer. The Contractor is not, and has no authority to act as,

a handler, generator, operator or disposer of hazardous or toxic substances found or identified at the site, and the Owner shall undertake all such functions.

END OF SECTION

SECTION 01330

SUBMITTALS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall provide the Engineer with submittals as required by the contract documents.

1.02 RELATED WORK:

A. Divisions 1 – 16 of these specifications that require submittals.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 GENERAL:

A. As required by the General Conditions, Contractor shall submit a schedule of shop and working drawing submittals.

B. The Contractor shall submit the shop and working drawing submittals either electronically or hard copy.

3.02 ELECTRONIC SUBMITTALS:

A. In accordance with the accepted schedule, the Contractor shall submit promptly to the Engineer by email or on Compact Disc electronic copy in Portable Document Format (PDF) of shop or working drawings required as noted in the specifications, of equipment, structural details and materials fabricated especially for this Contract.

B. Each electronic copy of the shop or working drawing shall be accompanied by the Engineer's standard shop drawing transmittal form, included as Exhibit 1 of this section (use only for electronic submittals), on which is a list of the drawings, descriptions and numbers and the names of the Owner, Project, Contractor and building, equipment or structure.

C. The Contractor shall receive a shop drawing memorandum with the Engineer's approval or comments via email.

3.03 HARD COPY SUBMITTALS:

A. In accordance with the accepted schedule, the Contractor shall submit promptly to the Engineer, six (6) copies each of shop or working drawings required as noted in the specifications, of equipment, structural details and materials fabricated especially for this Contract.

B. Each shipment of drawings shall be accompanied by the Engineer's (if applicable) standard shop drawing transmittal form on which is a list of the drawings, descriptions and numbers and the names of the Owner, Project, Contractor and building, equipment or structure.

3.04 SHOP AND WORKING DRAWINGS:

A. Shop and working drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish of shop coat, grease fittings, etc., depending on the subject of the drawings. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for this Contract.

B. All shop and working drawings shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them. All shop and working drawings shall be prepared on standard size, 24-inch by 36-inch sheets, except those, which are made by changing existing standard shop or working drawings. All drawings shall be clearly marked with the names of the Owner, Project, Contractor and building, equipment or structure to which the drawing applies, and shall be suitably numbered. Each shipment of drawings shall be accompanied by the Engineer's (if applicable) standard shop drawing transmittal form on which is a list of the drawings, descriptions and numbers and the names mentioned above.

C. Only drawings that have been prepared, checked and corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Contract Documents in all respects. Shop drawings shall be reviewed and marked with the date, checker's name and indication of the Contractor's approval, and only then shall be submitted to the Engineer. Shop drawings unsatisfactory to the Contractor shall be returned directly to their source for correction, without submittal to the Engineer. Shop drawings submitted to the Engineer without the Contractor's approval stamp and signature will be rejected. Any deviation from the Contract Documents indicated on the shop drawings must be identified on the drawings and in a separate submittal to the Engineer, as required under subsection 6.17 Shop Drawings and Samples; D. Submittal Procedures, Paragraph 3 of the 1996 General Conditions.

D. The Contractor shall be responsible for the prompt submittal and resubmittal, as necessary, of all shop and working drawings so that there will be no delay in the work due to the absence of such drawings.

E. The Engineer will review the shop and working drawings as to their general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections of comments made on the drawings during the review do not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. The review of the shop drawings is general and shall not relieve the Contractor of the responsibility for details of design, dimensions, code compliance, etc., necessary for interfacing with other components, proper fitting and construction of the work required by the Contract and for achieving the specified performance. The Engineer will review submittals two times: once upon original submission and a second time if the Engineer requires a revision or corrections. <u>The Contractor shall reimburse the Owner amounts charged to the Owner by the Engineer for performing any review of a submittal for the third time or greater.</u>

F. With few exceptions, shop drawings will be reviewed and returned to the Contractor within 30 days of submittal.

G. No material or equipment shall be purchased or fabricated especially for this Contract, nor shall the Contractor proceed with any portion of the work, the design and details of which are dependent upon the design and details of equipment or other features for which review is required, until the required shop and working drawings have been submitted and reviewed by the Engineer as to their general conformance and compliance with the project and its Contract Documents. All materials and work involved in the construction shall then be as represented by said drawings.

H. Two copies of the shop and working drawings and/or catalog cuts will be returned to the Contractor. The Contractor shall furnish additional copies of such drawings or catalog cuts when he needs more than two copies or when so requested.

3.05 SAMPLES:

A. Samples specified in individual Sections include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the work.

B. The number of samples submitted shall be as specified. Submittal and processing of samples shall follow the procedures outlined for shop and working drawings unless the specifications call for a field submittal or mock-up.

C. Acceptance of samples will be acknowledged via a copy of the transmittal noting status. When samples are not acceptable, prompt resubmittal will be required.

3.06 OPERATING AND MAINTENANCE MANUALS AND SPARE PARTS LISTS:

A. Where reference is made in technical specification sections to operating and maintenance manuals and/or spare parts lists, the Contractor shall submit four copies to the Engineer for review in accordance with the instructions furnished under "Shop and Working Drawings." If the submittal is complete and does not require any changes, an acknowledgement (copy of transmittal) will be returned noting status. If the submittal is incomplete or does require changes, corrections, additions, etc., two copies of the submittal will be returned with a copy of transmittal noting status. Four copies of the final operating and maintenance manuals and/or spare parts list shall be delivered to the Engineer prior to or with the equipment when it is delivered to the job site. For systems requiring field adjustment and balancing, such as heating and ventilating, the Contractor shall submit separate test results and adjustment data on completion of the work, to be incorporated into the system manual.

B. The information included in the manual shall be as described in the specification sections, but as a minimum shall contain clear and concise instructions for operating, adjusting, lubricating and maintaining the equipment, an exploded assembly drawing identifying each part by number and a listing of all parts of the equipment, with part numbers and descriptions required for ordering spare parts. Spare parts lists shall include recommended quantity and price.

C. Operating and maintenance manuals shall be in durable loose-leaf binders, on 8½-inch by 11-inch paper, with diagrams and illustrations either on 8½-inch by 11 inch or multiple foldouts. The instructions shall be annotated to indicate only the specific equipment furnished. Reference to other sizes or models of similar requirement shall be deleted or neatly lined out.

END OF SECTION

EXHIBIT 1 TO SECTION 01330 SUBMITTALS

SHOP DRAWING TRANSMITTAL FORM

(Refer to next page.)

Shop Drawing Transmittal

Weston&Sampson
ENGINEERS, INC.

Instructions for Preparing Transmittal

No action will be taken on any item unless accompanied by this form.
Type or print all entries.

TRANSMITTAL NOS. to be consecutive (1, 2, 3, etc.).
Each resubmittal of same item shall use same number with suffix letter (A, B, etc.).

SPEC. SECT. NO: Only one spec. section no. to each transmittal.

DESCRIPTION: Complete identification of document or group of documents.

SOURCE: Originator of document(s) being submitted.

DRAWING NO: Identification of document(s).

NO. of COPIES: Usually 6 or as directed/specified.

CONTRACT DRAWING REFERENCE: Contract drawing number(s) showing details of document(s) being submitted.

SPECIAL INSTRUCTIONS: Special cases and emergencies, changes in distribution and special handling requests, etc. should be entered here.

SIGNATURE OF CONTRACTOR: Signature of individual who reviews and approves material prior to submittal to engineer.

Contractor to retain last copy. Submit original with two pink and two yellow copies.

THIS SECTION TO BE COMPLETED BY CONTRACTOR

TRANSM. NO.	SPEC. SECT. NO.	DATE / /	CONTRACTOR'S JOB NO.	W&S JOB NO.

PROJECT NAME & CONTRACT NO.	LOCATION

TO	FROM
Attention: CSD Weston & Sampson Engineers, Inc. 5 Centennial Drive Peabody, MA 01960-7985	(CONTRACTOR)

ITEM NO.	DESCRIPTION	SOURCE	DRAWING NO. CATALOG NO. BROCHURE, ETC.	NO. OF COPIES	CONTRACT DRAWING REF.	BY W&S ACTION CODE	BY W&S REVIEWED BY
1							
2							
3							
4							

THIS CERTIFIES THAT ALL ITEMS SUBMITTED HEREWITH HAVE BEEN CHECKED BY THE CONTRACTOR, ARE IN CONFORMANCE WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, EXCEPT AS NOTED, AND ARE APPROVED BY THE CONTRACTOR FOR THIS PROJECT.

SPECIAL INSTRUCTIONS:

(FOR CONTRACTOR)
SIGNATURE & TITLE:

THIS SECTION TO BE COMPLETED BY W&S

ACTION CODE
1. NO EXCEPTIONS TAKEN
2. MAKE CORRECTIONS NOTED
3. AMEND AND RESUBMIT
4. REJECTED - SEE REMARKS
5. ACKNOWLEDGMENT

a. INSTALLATION SHALL PROCEED ONLY WHEN ACTION CODE IS 1 or 2.
b. ACTION CODED 3 SHALL BE RESUBMITTED WITHIN TIME LIMIT SET IN CONTRACT.
c. REVIEW DOES NOT RELIEVE CONTRACTOR FROM RESPONSIBILITY OF COMPLIANCE WITH ALL REQUIREMENTS OF THE CONTRACT DOCUMENTS.

FIELD OFFICE
REC'D BY
DATE / /

Weston&Sampson
ENGINEERS, INC.

BY _____ DATE / /

Please! **BEAR DOWN WHEN HANDWRITING — THIS IS A 6 COPY FORM & THE LAST COPY IS YOURS!**

SECTION 01450

SAMPLING & TESTING

PART I - GENERAL

1.01 SCOPE OF WORK

A. The work under this Section shall consist of performing or ordering the work of collecting samples for testing, having tests performed by a Certified Testing Laboratory satisfactory to the Engineer, having all test results forwarded to the Engineer for approval, and paying all costs associated with the collection and sampling, transportation, shipping, postage, and testing, and the coordination of test results and approvals.

1.02 SUBMITTALS

A. In accordance with Section 01330 of these Specifications, submit the names, addresses and certification of laboratories to be utilized for approval by the Engineer.

PART II - MATERIALS

2.01 CONTAINERS AND TOOLS

A. Utilize tools recommended by the laboratory to obtain samples, packaging or containers suitable to, or furnished by, the laboratory, and collect all samples in the proper number and quantity to permit tests to be conducted.

2.02 TESTS

A. Refer to section specifications for test requirements and criteria for results; Coordinate with the Engineer.

B. Compaction testing for accessible trail surfacing shall be performed as required by the Owner's Representative. All costs shall be the responsibility of the Contractor.

C. Compaction testing for base courses under athletic courts, pathways, and parking areas shall be performed as required by the Owner's Representative. All costs shall be the responsibility of the Contractor.

D. Cast in place concrete requires a slump and air entrainment test for every load of concrete delivered. All costs shall be the responsibility of the Contractor.

E. Should the contractor require soil testing for disposal, it is at their full expense. It

is expected that the site has typical urban fill component that may include brick, concrete, tires, and the like. These materials are to be disposed of at no additional expense to the owner.

PART III - EXECUTION

3.01 METHODOLOGY

A. Unless otherwise directed by the Section specifications, perform sampling and testing will be ordered by the Contractor and approved by the Owner's Representative. Locations, number and quantity of samples shall be submitted for approval as directed in accordance with the Specifications.

B. Sampling and Testing results must be provided to the Owner's Representative and Approved prior to the installation of any work potentially impacted by unacceptable test results.

3.02 PAYMENT

A. Payment for all sampling and testing efforts shall be included in the lump sum contract price bid.

- - - END OF SECTION - - -

SECTION 01451

STRUCTURAL TESTS AND INSPECTIONS

PART 1 -– GENERAL

1.01 WORK INCLUDED:

A. Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Obtaining, coordinating, and providing notifications to the Owner and Engineer.

2. Provide safe access to the work of this Contract to accommodate the indicated tests and inspections.

3. Implementing corrective action and providing additional tests and/or inspections for work identified as non-conforming by the Independent Testing Agency.

1.02 GENERAL REQUIREMENTS:

A. The Massachusetts State Building Code, Latest Edition, 780 CMR, requires the Structural Engineer of Record (SER) to provide a program of structural tests and inspections for this project.

B. Attachment A, Program of Structural Tests and Inspections, shall not relieve the Contractor or its subcontractors of their responsibilities and obligations for quality control of the Work; their other obligations for supervising the Work; for any design work which is included in their scope of services; for full compliance with the requirements of the Contract Documents; the detection of, or failure to detect, deficiencies or defects, whether detected or undetected, in all parts of the Work, and to otherwise comply with all requirements of the Contract Documents.

C. The Program of Structural Tests and Inspection does not apply to the Contractor's equipment, temporary structures used by the Contractor to construct the project, the Contractor's means, methods, procedures, and job site safety.

1.03 CONTRACTOR RESPONSIBILITIES:

A. The Contractor shall provide free and safe access to the Work for the SER and all other individuals who are observing the Work or performing structural tests or inspections. The Contractor shall provide all ladders, scaffolding, staging, and up-to-date safety equipment, all in good and safe working order, and qualified personnel to handle and erect them, as may be required for safe access.

B. The Contractor shall give reasonable notice to the Owner and the Engineer of when the various parts of the Work will be ready for testing and/or inspection. The Contractor shall notify the Owner and the Engineer a minimum of 48 hours before such tests and/or inspections are to take place.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

NOT USED.

ATTACHMENT A

PROGRAM OF STRUCTURAL TESTS AND INSPECTIONS

The following is a summary of Work subject to Tests and Inspections under the Program.

1. In-situ Bearing Strata for Footings
2. Controlled Structural Fill
3. Cast-In-Place Concrete
4. Masonry
5. Structural Steel

Abbreviation	Agent
SER	Structural Engineer of Record
ITA	Contractor – Independent Testing Agency

In-Situ Bearing Strata for Footings

Item	Agent	Scope
1. Bearing Strata QC Review	ITA	Review Contractor's field quality control procedures.
2. General Excavation	ITA	Inspect strata for conformance to the structural drawings, specifications, and/or geotechnical report.
3. General Excavation	ITA	Ensure that excavation is to proper depth or material.
4. General Excavation	ITA	Ensure that excavation is controlled and contains no unsuitable materials.
5. Bearing surfaces for footings	ITA	Inspect bearing surfaces for conformance to the requirements of the structural drawings, specifications, and/or geotechnical report.

Controlled Structural Fill

Item	Agent	Scope
1. Controlled Structural Fill QC Review	SER	Review Contractor's field quality control procedures
2. Fill Material	ITA	Test material for conformance to specifications or geotechnical report. Perform laboratory compaction tests in accordance with the specifications to determine optimum water content and maximum dry density.
3. Installation of controlled structural fill	ITA	Provide full-time inspection of the installation, in accordance with the specifications.
4. Density of Fill	ITA	Perform field density tests of the in-place fill in accordance with the specifications.

Cast-In-Place Concrete Construction

Item	Agent	Scope
1. Cast-In-Place Concrete Construction QC Review	SER	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
2. Mix Design	SER	Review Mix Designs
3. Materials	SER	Review material certifications for conformance to Specifications
4. Batching Plant	ITA	Review Plant quality control procedures and batching and mixing methods
5. Reinforcement Installation	ITA	Inspect reinforcing for size, quantity, condition and placement
6. Anchor Rods	ITA	Inspect anchor rods prior to and during placement of concrete.
6. Formwork	ITA	Inspect form sizes for proper sizes of concrete members.
7. Concrete Placement and Sampling fresh Concrete	ITA	Observe concrete placement operations. Verify conformance to specifications including cold-weather and hot-weather placement procedures. Perform slump, density and air content tests at point of discharge.
8. Evaluation of Concrete	ITA	Test and evaluate in accordance with the specifications.
9. Curing and Protection	ITA	Observe procedures for conformance to the specifications.

END OF SECTION

SECTION 01562

DUST CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This section of the specification covers the control of dust via water. No calcium chloride shall be used for dust control for this project.

PART 2 - PRODUCTS

2.01 WATER:

A. Water shall not be brackish and shall be free from oil, acid, and injurious alkali or vegetable matter.

PART 3 - EXECUTION

3.01 APPLICATION:

A. Water may be sprinkler applied with equipment including a tank with gauge-equipped pressure pump and a nozzle-equipped spray bar.

B. Water shall be dispersed through the nozzle under a minimum pressure of 20 pounds per square inch, gauge pressure.

END OF SECTION

SECTION 01570

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The work covered by this section of the specifications consists of furnishing all labor, materials, tools and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.

B. All work under this Contract shall be in accordance with the Conservation Commissions' Orders of Conditions as well as any conditional requirements applied, all of which are attached to Section 00890, PERMITS.

C. Prior to commencement of work, the Contractor shall meet with representatives of the Engineer to develop mutual understandings relative to compliance of the environmental protection program.

1.02 RELATED WORK:

A. Section 01562, DUST CONTROL

1.03 SUBMITTALS:

A. The Contractor shall submit for approval six sets of details and literature fully describing environmental protection methods to be employed in carrying out construction activities.

PART 2 - PRODUCTS

2.01 SILT FENCE:

A. The silt fence shall consist of a 3-foot wide continuous length sediment control fabric, stitched to a 22-foot wide, continuous length support netting, and stapled to preweathered oak posts installed as shown on the drawings. The oak posts shall be 1½-inches by 1½-inches (Minimum Dimension) by 48 inches and shall be tapered. The support netting shall be industrial strength polypropylene. The bottom edge of the sediment control fabric shall be buried as shown on the drawings. The sediment control fabric shall conform to the following properties:

Property	Value	Test Method
1. Grab Strength (lbs.)	124	ASTM D-4632
2. Elongation (%)	15%	ASTM D-4632
3. Puncture Strength (lbs.)	65	ASTM D-4833
4. Burst Strength (psi)	300	ASTM D-3786
5. Trapezoid Tear (lbs.)	60	ASTM D-4533
6. Equivalent Opening Size (U.S. Sieve)	No. 30	ASTM D-4571
7. Permittivity (sec^{-1})	0.10	ASTM D-4491
8. Water Flow Rate (gal/min/sf.)	10	ASTM D-4491
9. UV Resistance (%)	70	ASTM D-4355

B. The silt fence shall be Mirafi Envirofence manufactured by Mirafi, Inc. or approved equal.

2.02 STRAW WATTLES:

A. Straw Wattles shall consist of a 100% biodegradable exterior jute or coir netting with 100% wheat straw interior filling as manufactured by Granite Environmental, Inc., Sebastian, Florida (Phone: 888-703-9889; website: www.GraniteEnvironmental.com), or approved equal.

B. The wattles will be placed in a shallow trench (2-3 inches deep) and staked in the ground using wooden stakes. The wooden stakes will be placed at a minimum depth of 24-inches into the ground.

2.03 CATCH BASIN PROTECTION:

A. Silt Sacks shall be proprietary Siltsack units as manufactured by ACF Environmental, Inc. or approved equal.

PART 3- EXECUTION

3.01 NOTIFICATION AND STOPPAGE OF WORK:

A. The Engineer will notify the Contractor in writing of any non-compliance with the provisions of the Order of Conditions. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails to act promptly, the Owner may order stoppage of all or part of the work through the Engineer until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

3.02 AREA OF CONSTRUCTION ACTIVITY:

A. Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

3.03 PROTECTION OF WATER RESOURCES:

A. The Contractor shall not pollute the underground, perennial stream running under the property through a culvert with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.

B. Special measures should be taken to insure against spillage of any pollutants into public waters, including on-site inputs to the culvert.

3.04 PROTECTING AND MINIMIZING EXPOSED AREAS:

A. The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, temporary vegetation, mulching or other protective measures shall be provided as specified.

B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to insure that materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Engineer.

3.05 LOCATION OF STORAGE AREAS:

A. The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project, and shall require written approval of the Engineer. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.

B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any drainage infrastructure to the culvert. Adequate measures for erosion and sediment control such as the placement of baled straw or straw wattles around the downstream perimeter of stockpiles shall be employed to protect any downstream culvert input from siltation.

C. The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

3.06 PROTECTION OF LANDSCAPE:

A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Engineer. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.

B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.

C. Where, in the opinion of the Engineer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Engineer may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor. The Engineer will decide what method of restoration shall be used, and whether damaged trees shall be treated and healed or removed and disposed of under the provisions of Section 02230, CLEARING AND GRUBBING.

D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of the work.

3.07 CLEARING AND GRUBBING:

A. The Contractor shall clear and grub only on the Owner's land or the Owner's easements, and only the area required for construction operations, as approved by the Engineer.

3.08 DISCHARGE OF DEWATERING OPERATIONS:

A. If required, any water that is pumped and discharged from the work area as part of the Contractor's water handling shall be filtered by an approved method prior to its discharge into a drainage system.

B. The pumped water shall be filtered through filter fabric and baled straw, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

3.09 DUST CONTROL:

A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, to minimize creation and dispersion of dust. If the Engineer decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed. Calcium chloride shall be as specified under Section 01562, DUST CONTROL.

3.10 BALED STRAW:

A. To trap sediment and to prevent sediment from clogging drainage systems, **baled straw** shall be used where shown on the drawings. Care shall be taken to keep the bales from breaking apart. The bales should be securely staked to prevent overturning, flotation, or displacement. All deposited sediment shall be removed periodically.

3.11 ERECTION AND MAINTENANCE OF SILT FENCE:

A. Where indicated on the drawings or where required by the Engineer, the Contractor shall erect and maintain a temporary silt fence. The silt fence shall be used specifically to contain sediment from runoff water and to minimize environmental damage caused by construction.

3.12 CATCH BASIN PROTECTION:

A. Catch basin protection shall be used for every catch basin, shown on the plans or as required by the Engineer, to trap sediment and prevent it from clogging drainage systems or entering the culvert. Siltation fabric shall be securely installed under the catch basin grate. Care shall be taken to keep the siltation fabric from breaking apart or clogging. All deposited sediment shall be removed periodically and at times prior to predicted precipitation to allow free drainage flow. Prior to working in areas where catch basins are to be protected, each catch basin sump shall be cleaned of all debris and protected. The contractor shall properly dispose of all debris at no additional cost to the Owner.

3.13 STRAW WATTLES:

A. The wattles will be placed in a shallow trench (2-3 inches deep) and staked in the ground using wooden stakes. The wooden stakes will be placed at a minimum depth of 24-inches into the ground.

END OF SECTION

SECTION 01575

HANDLING EXISTING FLOWS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers all materials, equipment, and labor required to handle existing sanitary sewage flows and installation and maintenance of all temporary connections, plugs, and by-pass pumping. Upon completion of the restroom building service connection, all temporary plugs and connections shall be removed and flows returned to the existing sewer main on Upland Avenue Extension. Plug, fill, and abandon existing pipes and manholes as shown on the drawings or as specified herein.

1.02 RELATED WORK:

Section 01330, SUBMITTALS

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Six sets of complete, checked shop drawings, showing equipment and method of by-passing.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION

3.01 MAINTAINING EXISTING FLOWS:

A. The Contractor shall protect against surcharging of the existing system upstream of the work area by installing adequate temporary by-pass pumping to handle dry weather and wet weather flows.

B. The Contractor shall repair any damage that occurs to existing pipes and structures to the satisfaction of the Engineer. Work performed under this section shall be considered incidental and shall not be measured separately for payment.

C. The Contractor shall not allow sanitary flow to discharge to any salt or fresh water body by means of overflow, by-pass pumping, or any other method that may contaminate these water areas.

END OF SECTION

SECTION 01720

CONSTRUCTION LAYOUT

PART I - GENERAL

1.01 SCOPE OF WORK:

A. The work under this section shall consist of field staking the horizontal and vertical alignment of all essential features and proposed work, including pathways fields, fencing, walls, and other related features as shown on the plans, by a ***Registered Engineer or Land Surveyor***. The Contractor shall familiarize himself with the existing conditions and shall be responsible for locating or re-establishing survey field ties, property lines, and benchmarks indicated on the plans.

B. Existing survey tie information if available shall be provided by the City, or the Engineer upon request.

1.02 QUALIFICATIONS & SUBMITTALS:

A. The Contractor shall engage the services of a ***Professional Engineer or Land Surveyor Registered in the Commonwealth of Massachusetts*** and shall submit the name, address, and registration number of such person or persons to the Engineer in writing.

B. Whenever reference is made on the plans or in these specifications to a Land Surveyor registered in the Commonwealth of Massachusetts, the Contractor may substitute a Registered Professional Engineer, except that only a Registered Land Surveyor will be permitted to conduct property line or boundary surveys.

PART II - MATERIALS

2.01 LAYOUT AND STAKING:

A. The Contractor shall be responsible for furnishing all stakes, pins, and grade markings as required to implement the work of layout and staking and shall make all field adjustments ordered by the Engineer at no extra cost to the Owner.

B. Upon request by the Engineer, the Contractor shall make available to the Owner survey instruments necessary to check the proposed vertical and horizontal alignments at no extra cost.

PART III - EXECUTION

3.01 SURVEY LAYOUT:

A. The Contractor shall use the alignments shown on the plans to establish the layout of all proposed features and shall perform field adjustments as recommended by the Engineer.

B. The Surveyor shall lay out the essential or necessary grades and locations of site furnishings, footings, pavements, utilities, structures and other proposed elements. The surveyor shall verify the location of any existing spikes, stakes, pipes, drill holes, etc. and shall be responsible for their accuracy. Proposed features shall be located in relation to dimensions shown on the drawings and as adjusted by the Engineer.

C. The Contractor shall inform the Engineer when the general layout is completed and shall not begin excavation until the Engineer approves the various alignments. Any discrepancies encountered in field conditions shall be reported to the Engineer immediately and shall be adjusted as directed.

D. The Contractor shall be responsible for maintaining the correct vertical and horizontal alignment of all elements, which responsibility shall not be waived by the Engineer's approval of basic layout and stakeout.

END OF SECTION

SECTION 01740

CLEANING UP

PART 1 - GENERAL

1.01 DESCRIPTION:

The Contractor must employ at all times during the progress of his work adequate cleanup measures and safety precautions to prevent injuries to persons or damage to property. The Contractor shall immediately, upon direction by the Engineer provide adequate material, equipment and labor to cleanup and make safe any and all areas deemed necessary by the Engineer.

1.02 RELATED WORK:

A. Section 01110 CONTROL OF WORK AND MATERIALS

B. Section 01570 ENVIRONMENTAL PROTECTION

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

2.01 DAILY CLEANUP:

A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

B. Upon written notification by the Engineer, the Contractor shall within 24 hours clean up those areas, which in the Engineer's opinion are in violation of this section and the above referenced sections of the specifications.

C. If in the opinion of the Engineer, the referenced areas are not satisfactorily cleaned up, all other work on the project shall stop until the cleanup is satisfactory.

2.02 MATERIAL OR DEBRIS IN DRAINAGE FACILITIES:

A. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, gutters, drains, pipes, structures, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches,

channels, drains, pipes, structures, and work shall, upon completion of the work, be left in a clean and neat condition.

2.03 REMOVAL OF TEMPORARY BUILDINGS, STRUCTURES AND EQUIPMENT:

A. On or before completion of the work, the Contractor shall, unless otherwise specifically directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools and machinery or other construction equipment furnished by him; shall remove all rubbish from any grounds which he has occupied; shall remove erosion controls used for trapping sediment; and shall leave the roads and all parts of the property and adjacent property affected by his operations in a neat and satisfactory condition.

2.04 RESTORATION OF DAMAGED PROPERTY:

A. The Contractor shall restore or replace, when and as directed, any property damaged by his work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk and landscaping work. Materials, equipment, and methods for such restoration shall be as approved by the Engineer.

2.05 FINAL CLEANUP:

A. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the construction site to its original or specified condition. This cleanup shall include removing all trash and debris off of the premises. Before acceptance, the Engineer shall approve the condition of the site.

END OF SECTION

SECTION 01770

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers administrative and procedural requirements for closing out the project, including, but not limited to:

1. Project as-built documents

2. Checkout and Certification

3. Final Cleaning

4. Substantial Completion

5. Closeout Procedures

6. Final Completion

7. Correction/Warranty Period

B. Closeout checklist to be completed by the Engineer.

1.02 RELATED WORK:

A. General Requirements in their entirety.

B. Section 01740, CLEANING UP

C. Division 1 through Division 16.

1.03 AS-BUILT DOCUMENTS:

A. Contractor shall maintain on site, separate from the documents used for construction, one set of the documents listed below, and as construction progresses, shall legibly record on these documents all changes made during construction.

1. Contract Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other Modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.

6. Written interpretations and clarifications.

7. Field Orders.

8. Field test reports properly verified.

B. The completed set of as-built documents shall be submitted to the Engineer with the final Application for Payment.

1.04 CHECKOUT AND CERTIFICATIONS:

A. Prior to checkout and certifications the following tasks shall be completed:

1. Construction shall be complete. For this purpose, completion of construction is defined as follows:

a. The Contractor has completed construction and erection of the work in conformance with the Contract Drawings and Specifications.

b. The Contractor has installed and adjusted operating equipment, systems, or facilities, as applicable, as defined by the manufacturers' erection, installation, operation and maintenance instructions.

2. All shop drawings shall have final approval.

3. All shop tests shall be complete and approved test results submitted to the Engineer.

1.05 FINAL CLEANING:

A. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Clean the site, including landscape development areas of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to smooth, even textured surfaces.

2. Remove waste and surplus materials, rubbish, fencing equipment, temporary utilities and construction facilities from the site, unless otherwise required by the Engineer.

3. Comply with requirements of Section 01740 CLEANING UP.

1.06 SUBSTANTIAL COMPLETION:

A. Substantial Completion is officially defined in the General and Supplementary Conditions. The date of substantial completion will be certified by the Engineer. This date will not be certified until the following requirements have been satisfied by the Contractor:

1. All Contract requirements are coordinated into a fully operational system. All individual units of equipment and treatment are fully operative and performing at specified efficiencies. Where efficiencies are not specified, performance shall meet acceptable standards for the particular unit.

2. All field tests have been satisfactorily completed and reports forwarded to the Engineer.

3. All final training has been completed by the manufacturers' representatives.

4. All spare parts and lubricants have been satisfactorily delivered to the Owner. Spare parts are for the exclusive use of the Owner when the facility has been turned over. Contractor is responsible for all maintenance and repair materials required until the facility is accepted by the Owner.

1.07 CLOSEOUT PROCEDURES:

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and is complete in accordance with Contract Documents and ready for Engineer's and Owner's inspection.

B. Accompany Engineer and Owner on inspection to verify conformance with the Contract Documents. Prepare a punch list of work items that have been determined by inspection to not conform to Contract Documents. Punch list items shall include work items that are missing, incomplete, damaged, incorrect items, or improperly installed or constructed. The Contractor shall correct the punch list deficiencies by re-work, modifications, or replacement, as appropriate, until the items conform to the Contract Documents. The initial punch list shall be produced by the Contractor, with copies to the Engineer and Owner. When the Contractor has reduced the number of deficient items to a reasonable level, the Engineer will develop a definitive punch list for the use of the Contractor.

C. Provide submittals to Engineer that are required by governing or other authorities.

D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due. The Contractor shall submit the following documents with or prior to Final Application for Payment: Set of as-built documents, Contract Completion and Acceptance Certificate, Consent of Surety to Final Payment, Release and Waiver of Liens and Claims, Affidavit of Payment of Debts and Claims, and remaining releases, waivers, warranties/guarantees, and all other data required by the Contract Documents.

1.08 FINAL COMPLETION:

A. Prior to final completion, the following tasks shall be completed:

1. All items in the punch list shall be completed.

2. All Contract closeout documentation shall be submitted to and accepted by the Engineer.

1.09 CORRECTION/WARRANTY PERIOD:

A. During the correction period, the Contractor shall correct all deficiencies in equipment and materials.

B. During the warranty period, the Contractor shall perform all corrective work on warranty deficiencies.

C. Corrective work will be identified by the Engineer or Owner, as appropriate. The Contractor will be notified of the item(s) requiring corrective work.

D. The Contractor shall begin work on all corrective work within ten days of being notified of the deficiency by the Engineer and shall then work continuously until the deficiency is corrected. Upon completion of the corrective work, the Contractor shall submit a letter report to the Engineer describing the deficiency and the corrective action that was taken.

E. The Contractor shall coordinate all corrective work with the Engineer and/or the Owner.

1.10 COMPLETION CHECKLIST EXAMPLE:

EXAMPLE

PROJECT COMPLETION CHECKLIST

Owner _____ Job No.

Project

As part of the project closeout, all items listed below must be checked off as being complete or otherwise accounted for. The person verifying completion of the item shall list the completion date and his/her initials.

Project Closeout Checklist		
	Date Completion Verified	Verified by
AS-BUILT DOCUMENTS HANDED OVER		
1. Contract Drawings		
2. Specifications		
3. Addenda		
4. Change Orders/Contract Modifications		
5. Reviewed Shop Drawings, Product Data and Samples		
6. Written Interpretations/Clarifications		
7. Field Orders		
8. Field Test Reports		
EQUIPMENT CHECKOUT AND CERTIFICATIONS		
1. Construction Complete per Drawings/Specifications		
2. Equipment Installed and Adjusted		
3. All Shop Drawings have Final Approval		
4. All Shop Tests Complete and Results Submitted		

Project Closeout Checklist		
	Date Completion Verified	Verified By
START-UP AND TESTING		
1. All Checkout and Certifications Complete		
2. All O&M Manuals Approved		
3. All Preliminary Training by Manufacturers Rep. Completed		
FINAL CLEANING		
1. All Construction Facilities Removed		
2. All Construction Debris Removed		
3. All Areas Swept/Cleared		
SUBSTANTIAL COMPLETION		
1. All Items Coordinated Into a Fully Operational System		
2. All Equipment Units Operational at Specified Efficiencies		
3. All Field Tests Completed and Reports Submitted		
4. All Final Training by Manufacturer's Rep. Completed		
5. All Spare Parts and Lubricants Provided		
CLOSEOUT PROCEDURES		
1. Written Certification Submitted that Work is Ready for Owner & Engineer Inspector		
2. Inspection by Owner, Engineer, Contractor completed		
3. Punch List of Nonconforming Items Prepared		
4. Documents Required by Governing or Other Authorities Submitted (List Them)		
5. Final Application for Payment Received		
6. Contact Completion and Acceptance Certificate Submittal		
7. Consent of Surety to Final Payment Submittal		
8. Release and Waiver of Liens and Claims Submitted		

Project Closeout Checklist	Date Completion Verified	Verified By
9. Affidavit of Payment of Debts and Claims Submitted		
10. Warranties/Guarantees Submitted		
11. Other Required Releases and Waivers Submitted (List Them)		
12. Permits Submitted (List Them)		
13. Weekly Payrolls Submitted as Required by Law		
FINAL COMPLETION		
1. All Items in Punch List Completed		
2. All Other Required Documentation Submitted (List It)		
CORRECTION/WARRANTY PERIOD		
1. Correction Period Start Date: _____ End Date: _____		
2. Specific Warranties Provided Item Warranty Duration		

Full name of persons signing their initials on this checklist:

_____

_____

_____

_____

_____

END OF SECTION

SECTION 02051

ASBESTOS ABATEMENT

This asbestos abatement specification has been developed to facilitate the removal and/or disturbance of asbestos containing materials in a proper and controlled manner at the athletic field building(s) at the Newton Highlands Playground site.

The purpose of this specification is to provide the guidelines necessary to properly demolish, remove, and dispose of various asbestos-containing materials as outlined herein. The asbestos abatement subcontractor ("Contractor") shall provide all necessary labor, materials, equipment, and resources to remove, package and properly dispose of the specified asbestos-containing materials (ACM) located within the work areas. The Contractor shall also perform selective demolition activities as necessary to complete the project. All work shall be performed in accordance with applicable federal, state, and local regulations.

PART 1 - GENERAL

1.01 GENERAL PROVISIONS:

A. The General Provisions of the contract apply to the work specified within this Section.

B. Removal shall be performed by a Massachusetts-licensed Asbestos Abatement Contractor. The abatement Contractor must comply with all requirements outlined in Massachusetts DLS Regulations, U.S. EPA NESHAP 40 CFR 61; and OSHA 29 CFR 1926.1101, including all applicable local ordinances.

C. Contractor shall furnish all labor, worker training, materials, equipment, and services for the complete and proper removal and disposal of asbestos-containing materials, as noted in Section 1.03 of this specification.

1.02 SCOPE OF WORK – GENERAL:

A. The following is the Scope of Work, at a minimum, required to be performed by the asbestos abatement Contractor in the work areas, under the total base bid.

1. Removal and disposal of all specified asbestos-containing materials (ACM).

2. Non-ACMs within the work areas that will not be impacted by the abatement activities shall be covered with 2-layers of polyethylene sheeting.

3. Work area preparations, including installation of solid barriers, critical barriers and polyethylene sheeting, construction of decontamination facilities, work area enclosures, sealing, isolation, and other activities as directed by the Engineer.

4. Installation and operation of HEPA filtration units as necessary in accordance with federal, state, and local regulations.

5. Decontamination and clean up following removal activities in each designated work area.

6. Performance of any other work or activities required by this specification, applicable regulations, or as necessary to perform a complete job to the satisfaction of the Owner and Engineer.

7. Compliance with all applicable federal, state, and local regulations, as well as all requirements set forth in this specification and facility requirements.

1.03 SCOPE OF WORK – DETAILED:

A. Asbestos Abatement Scope of Work

The following is the approximate location and quantities of asbestos-containing materials to be removed from the site building, in accordance with this Section, under the Base Bid:

Location	Asbestos-Containing Material	Estimated Quantity
Trailer		
Exterior	Tan and White Window Caulking	15 Windows ~4'x5'
Exterior	Seam Caulking	300 LF

1. Asbestos abatement within the all work areas is to be closely coordinated with the Owner and the Engineer. Multiple mobilizations to the site may be necessary to complete the scope of work defined herein.

2. The Contractor shall perform demolition to access all ACMs outlined in the table above, including but not limited to door/window frames, roof flashing, paneling, sills, and/or lintels constructed of metal, wood and/or masonry.

3. Cutting/capping and "make safe" of electrical and plumbing fixtures is to be conducted by the General Contractor.

1.04 SEQUENCE OF WORK:

The following is a typical sequence of work that the Contractor shall adhere to during the asbestos abatement project. The Engineer may authorize deviations from this typical sequence based upon the specific conditions encountered during the project.

1. Contractor shall post all required signage.

2. Contractor shall secure area from unauthorized access.

3. Contractor shall remove all movable objects from the work area.

4. Contractor shall cover all immovable objects and objects not removed from the work area with two (2) layers of six (6)-mil polyethylene sheeting, sealed airtight with duct tape. Contractor shall install critical barriers at all points of access required by regulations.

5. As necessary, Contractor shall install HEPA filtration units, as required by these Specifications, sufficient to achieve a minimum of four (4) air changes per hour. All such units shall exhaust to the outside of the building.

6. Contractor shall prepare the specified Work Area for total isolation as described in this Specification. Surfaces subject to abatement shall be excluded from the plasticizing requirements of the applicable regulations. Preparation shall include two (2) layers of six (6)-mil polyethylene sheeting, sealed with duct tape, on all floors (in areas where flooring materials are not subject to abatement) and non-impervious surfaces, and two layers of four (4)-mil polyethylene sheeting on all walls.

7. Contractor shall construct decontamination units for each phase within the work areas formed by plywood demising walls, and any other construction needed to complete the work area to the satisfaction of Engineer. A remote decontamination unit as described in Massachusetts regulations shall be acceptable for exterior work.

8. Engineer shall inspect and approve all work area preparations before permitting Contractor to begin removal work.

9. Contractor shall remove all ACMs and non-ACMs identified in each work area. Exposed flooring shall be covered with a minimum of two layers of 6-mil polyethylene sheeting.

10. Contractor shall decontaminate the work area upon completion of removal.

11. Engineer's licensed project monitor shall perform a final visual inspection to assure that no visible debris exists in each work area. Contractor shall re-clean the work areas as needed until they pass a visual inspection by a licensed project monitor.

12. As necessary, Engineer will perform required final air clearance testing in each work area. Satisfactory results are required before containment may be removed.

13. Contractor shall remove all work area barriers, equipment, polyethylene sheeting, etc. and clean any areas to the satisfaction of Engineer and Owner.

1.05 SUBMITTALS:

A. Pre-Abatement Submittals

The Contractor shall submit the following documentation prior to the commencement of project activities:

1. Name and cell phone number of the on-site Massachusetts-licensed Asbestos Abatement Supervisor.

2. Copy of the required regulatory notification for the work of this contract.

3. Proposed schedule of completion.

4. Required Certificate of Insurance.

B. Post-Construction Submittals

The Contractor shall submit the following to the Engineer within thirty (30) days after completion of the project:

1. Manifests and waste receipts acknowledging disposal of all waste material from the project showing delivery date, quantity, and appropriate signature of landfill's authorized representative,

2. A copy of the entry-exit logbook required elsewhere in these specifications,

3. Copy of licenses, medical, and fit tests of all workers and supervisors who performed work on the project,

4. All notifications and/or permits and fees as required in these specifications and by local, state or federal regulations.

1.06 REGULATORY SUBMITTALS:

A. The Contractor shall be responsible for securing all necessary permits for asbestos related work, including hauling, removal, and disposal, fire, and materials usage, or any other permits required to perform the specified work.

B. The Contractor shall notify the following agencies in appropriate manner and place of impending work, and shall provide evidence of notifications at the pre-construction conference:

1. U.S. Environmental Protection Agency
J. F. Kennedy Federal Building
Boston, Massachusetts 02203
(10 working days in advance)

2. Massachusetts Department of Environmental Protection
DEP Northeast Region Main Office
205 Lowell Street
Wilmington, MA 01887 (10 working days in advance)

3. Any other required local regulatory agencies, including, but not limited to the local Board of Health, Police and Fire Department.

1.07 PROJECT CONDITIONS

A. Take all measures and provide all material necessary for protecting fixed machinery, controls, instrumentation, equipment, and furniture from asbestos fiber, dust and debris and from water damage.

B. Working space and space available for storing materials is restricted within the confines of the project and/or at locations to be designated by the Owner.

C. Water, electric power, lighting and other utilities, toilets, and other facilities shall be provided by the Contractor.

D. Post and affix caution signs and labels as required by OSHA regulation, 29.CFR.1926.1101 (k) (1). Post safety signs outside the work project as may be required by the Owner. Obtain two copies of 29.CFR.1910.1001, 29.CFR.1926.1101, 40.CFR.61, Subpart M, and New Hampshire Regulations.

E. Contractor shall document daily work site activities in a daily log book which shall be retained at the job site. Daily log entries shall include, but not be limited to work area containment locations, number of workers, containment breach episodes, visitors to the site and personnel air sampling results.

1.08 SPECIAL CONSIDERATIONS

A. General Demolition

1. In addition to the abatement of asbestos-containing materials, it will be the Contractor's responsibility to remove and dispose specified non-asbestos-containing materials to access ACMs for removal.

B. Final Air Clearance Tests

1. All final air tests and final visual inspections will be performed as necessary by the Engineer's Massachusetts-licensed Asbestos Project Monitor in accordance with DLS regulations, this Specification, and other applicable Rulings (i.e., AHERA). The Owner will pay for the first set of final clearance air tests for each removal area. In the event that these air tests do not pass the clearance criteria, the Contractor shall pay for any subsequent air tests that need to be performed. All additional sampling costs will be automatically deducted from the contract price until the areas in question pass the final air clearance criteria of less than 0.010 fibers per cubic centimeter for PCM clearance testing.

C. Additional Considerations

1. Storage

Contractor will supply any temporary storage as needed. All materials and equipment are to be kept in orderly fashion in designated areas, free and clear of halls and doorways, and in conformance with all regulations, codes, and in consideration of building usage. Contractor will be allowed to store waste in a waste dumpster on-site, to be coordinated with the Owner.

2. Working Hours

Working hours will be determined by the Owner in the Pre-Construction meeting prior to the start of the Project.

3. Security

a. The Owner will provide specific access as required during the project to the Contractor and personnel assigned to the project. The Contractor will be responsible for the security of the section of the building involved in the abatement project. It will also be the Contractor's responsibility to allow only authorized personnel into the work area, and to secure all assigned entrances and exits at the end of the workday.

b. Any person entering or leaving the contained areas must sign the Contractor's bound logbook and enter the date and time of entry. The logbook must be located immediately outside the entrance to the Decontamination Unit at all times, and be open for inspection by the Owner.

END OF SECTION

SECTION 02071

GEOTEXTILE FABRICS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers furnishing of all labor, materials, and equipment necessary to install specified geotextile fabrics in locations shown on the drawings and as required by the Engineer.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Six (6) sets of shop drawings or working drawings and material specifications shall be submitted to the Engineer for review for each type of geotextile fabric furnished. General installation practices and installation schedule shall be included.

PART 2 - PRODUCTS

2.01 EROSION CONTROL FABRIC

A. Erosion Control Fabric shall be of the best quality proven design and construction and shall be entirely suitable in every respect for the intended service.

B. Erosion Control fabric shall be Miramat Erosion Control/Revegetation MAT (ECRM) as manufactured by Mirafi Inc., Pendergrass, GA; Enkamat Soil Erosion Matting as manufactured by BASF Corporation Fibers Division, Enka, N.C.; Tenax Erosion Control Netting as manufactured by ATP Corporation, Ashtabula; Ohio or approved equal.

2.02 FILTER/DRAINAGE FABRIC:

A. The filter/drainage fabric shall be composed of continuous-filament fibers bonded together to form a sheet. The fabric shall be an average of 20 mils thick and possess the characteristics of Mirafi 140N.

B. The filter/drainage fabric shall be Mirafi 140N as manufactured by Mirafi Inc., Pendergrass, GA; Foss-65 by Foss Manufacturing Co., Hampton, NH; US 120NW, as manufactured by US Fabrics, Cincinnati, OH, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. GENERAL:

Installation of geotextile fabrics shall be strictly in accordance with manufacturer's instructions and specific layout plans and details reviewed by the Engineer.

B. EROSION CONTROL FABRIC:

Erosion control fabric shall be placed over the prepared surface in drainage swales and other locations as required by the Engineer. The fabric shall be unrolled, placed in the direction of water flow, overlapped, pinned down with wood stakes, and seeded. All installation work shall be in accordance with manufacturer's recommendations or as required by the Engineer.

C. FILTER/DRAINAGE FABRIC:

The filter/drainage fabric shall be installed in the final graded trench bottom prior to placement of the crushed stone bedding and at other locations shown on the drawings or designated by the Engineer. The drainage fabric in place shall cover the entire trench bottom and trench sides as shown on the drawings. Each width of drainage fabric shall be overlapped in accordance with manufacturer’s recommendations, but not less than 2 feet, to prevent intrusion of soil fines into the bedding.

3.02 FINAL INSPECTION AND ACCEPTANCE:

A. The Contractor shall, at his expense, have a manufacturer's representative inspect the work at completion of the installation. Any work found to be unsatisfactory shall be corrected at the Contractor's expense.

B. The Engineer, at the Contractor's expense, reserves the right to have a manufacturer's representative inspect the installation process at any time during construction.

END OF SECTION

SECTION 02085

POLYVINYL CHLORIDE GRAVITY PIPE AND FITTINGS (SDR-35)

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers the furnishing and installation of Polyvinyl Chloride (PVC) pipe and fittings, as indicated on the drawings and as specified herein.

1.02 RELATED WORK:

A. Section 02252, SUPPORT OF EXCAVATION

B. Section 02300, EARTHWORK

1.03 REFERENCES:

A. The following standards form a part of these specifications as referenced:

American Society for Testing and Materials (ASTM)

ASTM	D2321	Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
ASTM	D3034	Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM	D3212	Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM	F679	Specification for Polyvinyl Chloride (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Six sets of manufacturer's literature of the materials of this section shall be submitted to the Engineer for review.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. PVC nonpressure sewer pipe 4-inches through 15-inches diameter shall conform to ASTM D3034, 18-inches through 60-inches diameter to ASTM F679, all with SDR of 35 unless noted, and shall meet the specific requirements and exceptions to the aforementioned specifications that follow.

B. PVC nonpressure sewer pipe shall be furnished in standard lengths.

C. One pipe bell consisting of an integral wall section with a solid cross section rubber ring, factory assembled, shall be furnished with each standard, random and short length of pipe. Rubber rings shall be provided to the requirements of ASTM D3212.

D. The rubber ring shall be retained within the bell of the pipe by a precision formed groove or recess designed to resist fishmouthing or creeping during assembly of joints.

E. Spigot pipe ends shall be supplied with bevels from the manufacturer to ensure proper insertion. Each spigot end shall have an "assembly stripe" imprinted thereon to which the bell end of the mated pipe will extend upon proper jointing of the two pipes.

F. PVC fittings shall be provided with bell and/or spigot configurations with rubber gasketed joints compatible with that of the pipe. Bend fittings with spigot ends shorter than the pipe recess bells will not be allowed. The shorter spigot end would not allow proper seating of the spigot in the mating bell and would permit undesired contact between the mating bell and the outside of the fitting bell.

G. All pipe delivered to the job site shall be accompanied by independent testing laboratory reports certifying that the pipe and fittings conform to the above-mentioned specifications. In addition, the pipe shall be subject to thorough inspection and tests, the right being reserved for the Engineer to apply such of the tests specified as he may from time to time deem necessary.

H. All cutting of pipe shall be done with a machine suitable for cutting PVC pipe. Cut ends shall be beveled when recommended by the pipe manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Except as modified herein, installation of the PVC pipe shall be in accordance with ASTM D2321.

B. Each pipe length shall be inspected before being laid to verify that it is not cracked. Pipe shall be laid to conform to the lines and grades indicated on the drawings or given by the Engineer. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.

C. The pipe shall be supported by compacted crushed stone. Crushed stone shall be as specified under Section 02300, EARTHWORK.

D. The pipe shall not be driven down to grade by striking it with a shovel handle, timber, rammer, or other unyielding object. When each pipe has been properly bedded, enough of the backfill material shall be placed and compacted between the pipe and the sides of the trench to hold the pipe in correct alignment.

E. Before a joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that inverts are matched and conform to the required line and grade.

F. For pipe placed on crushed stone, immediately after the joint is made, the jointing area shall be filled with suitable materials so placed and compacted that the ends of either pipe will not settle under backfill load.

G. No pipe or fitting shall be permanently supported on saddles, blocking, or stones.

H. Branches and fittings shall be laid by the Contractor as indicated on the drawings, and/or as required by the Engineer. Open ends of pipe and branches shall be closed with PVC caps secured in place with premolded gasket joints or as required by the Engineer.

I. All pipe joints shall be made as nearly watertight as practicable. There shall be no visible leakage at the joints and there shall be no sand, silt, clay, or soil of any description entering the pipeline at the joints. Where there is evidence of water or soil entering the pipeline, connecting pipes, or structures, the defects shall be repaired to the satisfaction of the Engineer.

J. The Contractor shall build a tight bulkhead in the pipeline where new work enters an existing sewer. This bulkhead shall remain in place until the Engineer authorizes its removal.

K. Care shall be taken to prevent earth, water, and other materials from entering the pipe, and when pipe laying operations are suspended, the Contractor shall maintain a suitable stopper in the end of the pipe and also at openings for manholes.

L. As soon as possible after the pipe and manholes are completed on any street, the Contractor shall flush out the new pipeline using a rubber ball ahead of the water, and none of the flushing water or debris shall be permitted to enter any existing sewer.

3.02 QUALITY ASSURANCE

A. LEAKAGE TESTING:

1. On completion of a section of sewer, including building connections installed to the property line, the Contractor shall install suitable bulkheads as required, dewater and test the sewer for leakage.

2. Unless otherwise approved, the section shall be tested using low pressure air test procedures. If circumstances permit, the Engineer may allow testing by infiltration or exfiltration in lieu of air testing.

3. The air test procedures shall conform to the Uni-Bell Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe, UNI-B-6. The starting air pressure for the test shall be 4 psig (greater than the average groundwater back pressure of any groundwater above the pipe, but not greater than 9.0 psig). The minimum duration permitted for the prescribed low pressure air exfiltration pressure drop between two consecutive manholes shall not be less than provided in Table I or Table II of UNI-B-6. **Note that UNI-B-6 suggests that use of the 0.5 psig pressure drop is more efficient since the time requirements are half of the 1.0 psig-pressure drop.** The two tables are reproduced on the following pages.

4. Using the air pressure test, if there has been no leakage (zero psig drop) after one hour of testing, the section undergoing test shall have passed.

5. If either infiltration or exfiltration testing is permitted by the Engineer, the test shall be conducted for at least 24 hours. The amount of infiltration or exfiltration shall not exceed 100 gallons per inch-diameter per mile of sewer per 24 hours.

6. The infiltration test measures leakage into a section of sewer and may be used only where the groundwater level is one foot or more above the crown of the section of sewer pipe at its upper end and at least one foot above the top of building connections and chimneys. For making the infiltration tests, underdrains, if used, shall be plugged and other groundwater drainage shall be stopped to permit the groundwater to return to its normal level insofar as practicable. Allowances shall be made for water that may enter the sewer through pipe connections and inlets during the infiltration test.

7. Where the groundwater level is less than 1 foot above the top of the pipe at its upper end, the exfiltration test may be used. The sewers shall be subjected to an internal pressure by plugging the pipe at the lower end and then filling the pipelines and manholes with clean water to a height of 2 feet above the highest point in the system to be tested, including main pipeline, service connections and chimneys. When slopes between manholes are steep, the Contractor shall insure that this test can be accomplished without danger of forcing stoppers from wye or tee branches.

8. The rate of exfiltration from the sewers shall be determined by measuring the amount of water required to maintain the water level at the elevation established at the beginning of the test.

9. The Contractor shall construct such weirs or other means of measurements as may be required, shall furnish water and shall do all necessary pumping to enable the test to be properly made.

10. The Contractor shall be responsible for the satisfactory watertightness of the entire section of sewer. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing leaks and retesting as the Engineer may require without additional compensation. A plan of the method of repairing any leaks that are found shall be submitted to the Engineer for review.

B. PIPE DEFLECTION MEASUREMENT:

1. In accordance with ASTM D3034, no less than 30 days after completion of the PVC sewer pipe installation, the Contractor shall test the pipeline for deflection using a "go/no-go" deflection mandrel having a minimum of nine evenly spaced arms or prongs. The "go/no-go" gauge shall be hand pulled through all sections of the pipeline by the Contractor. The Contractor shall submit drawings of the "go/no-go" gauge to the Engineer for approval prior to testing. Complete dimensions of the gauge for each diameter of pipe to be tested shall be in accordance with ASTM D3034.

2. Any section of pipe found to exceed 7.5 percent deflection shall be deemed a failed pipe and shall be excavated and replaced by the Contractor at his own expense.

TABLE I

MINIMUM SPECIFIED TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

Pipe Diameter (in)	Minimum Time (min:sec)	Length for Min. Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.52 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46
42	39:48	57	41.883 L	69:48	104:42	139:37	174:30	209:24	244:19	279:13	314:07
48	45:34	50	54.705 L	91:10	136:45	182:21	227:55	273:31	319:06	364:42	410:17
54	51:02	44	69.236 L	115:24	173:05	230:47	288:29	346:11	403:53	461:34	519:16
60	56:40	40	85.476 L	142:28	213:41	284:55	356:09	427.23	498:37	569:50	641:04

TABLE II

MINIMUM SPECIFIED TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

Pipe Diameter (in)	Minimum Time (min:sec)	Length for Min. Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10:683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12:926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15:384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:54	57	20.942 L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04
48	22:47	50	27.352 L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09
54	25:31	44	34.618 L	57:42	86:33	115:24	144:15	173:05	201:56	230:47	259:38
60	28:20	40	42.738 L	71:14	106:51	142:28	178:05	213:41	249:18	284:55	320:32

END OF SECTION

SECTION 02220

DEMOLITION

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. Complete demolition of two building structures (this includes an equipment trailer and a brick and CMU building used as a concession stand with associated restrooms) and existing site features as stipulated throughout the Contract Documents, to generally include the following:

1. **At the two buildings to be demolished, complete all asbestos abatement and lead based coatings removals prior to demolishing/removing any building element in accordance with Specification Sections 02051 and 13282 respectively.**

2. Complete demolition and complete removal and disposal of all interior and exterior building elements including floors, slabs, walls, ceilings and roof structures.

3. Complete demolition and complete removal and disposal of all interior and exterior building elements and contents including all building equipment and fixtures.

4. Complete demolition and complete removal and disposal of all building components and all associated footings, supports and exterior site features.

5. Complete demolition and complete removal of all tennis and basketball court pavements, fencing, and associated equipment.

6. Complete demolition and complete removal of baseball backstop, fencing, and infield mix.

7. Complete demolition and complete removal of play equipment, fencing, and play surfacing.

8. Complete demolition and complete removal of sports lighting, controls, and associated conduit.

9. Complete demolition and complete removal of irrigation heads and laterals.

10. Stripping and stockpiling of existing soils.

11. Complete demolition and complete removal of all other site items as indicated on the plans.

12. Salvaging of limited site features if designated on the Contract Documents.

13. Identifying, cutting, capping and abandonment of all utility systems as detailed and specified throughout the Contract Documents.

14. Installation of environmental controls including silt fencing / erosion controls prior to commencing work of any kind on premises.

15. Protection of the adjacent properties, coordination with the City of Newton representatives as needed and required, conducting of demolition and restoration operations in a manner that does not disrupt or inconvenience normal activities and/or special events at the property.

B. Prospective bidders are advised that certain materials and equipment will have been salvaged and removed from the premises by the City of Newton prior to initiation of the work of this contract.

C. Restoration of all project areas upon the successful and satisfactory execution of all demolition efforts as specified throughout the Contract Documents.

1.02 REGULATORY REQUIREMENTS:

A. Conform to applicable codes and requirements for demolition of structure, safety of adjacent structure, dust control, service utilities, and discovered hazards.

B. Dispose or recycle all demolition debris in accordance with all applicable regulations.

1. Contractor is solely responsible for obtaining permits or approvals which may be required to perform the work of this Section, including all costs, fees and taxes required or levied. All legally imposed charges made by local authorities for the work of this Section involving the connection, inspection and approval services of all bureaus administering all applicable codes and regulations shall be provided hereunder at no additional expense to the Owner.

2. Notify and obtain such permits or approvals from all agencies having jurisdiction over demolition prior to starting work including, but not limited to Health, Building, and Fire Departments of the municipality and local, State and Federal agencies. The Contractor shall give the proper authorities all required notices or information relating to work in his charge, pay all fees necessary to obtain all official licenses, permits and certificates, and comply with the rules of the Massachusetts Department of Public Safety.

3. Comply with all applicable Federal, State, and local environmental, safety and health requirements and regulations regarding the demolition of structures and other site features and recycling or disposal of demolition debris, as applicable.

4. Conform to applicable codes and requirements for demolition of structures, safety of adjacent structures, dust control, service utilities, and discovered hazards.

1.03 PROTECTION:

A. The Contractor shall assume complete responsibility and liability for the safety and structural integrity of all work and utilities to remain during demolition. The contractor shall take special care when working within or near the drainage culvert easement. Refer to plans for location.

B. Provide safeguards including, but not limited to, warning signs, barricades, temporary fences, warning lights and other items required for protection of personnel and the general public during performance of all work.

C. All features related to protection shall be maintained until that work has been completed to the point when such safeguards are no longer required.

D. Install erosion controls to protect adjacent areas from eroded materials likely to enter adjacent properties, resource areas, or drainage ways/systems, downstream of areas disturbed by work activities.

D. Where items to be demolished are located within or adjacent to pavements to remain, the Contractor shall make provisions to protect that pavement to remain. Cut concrete pavement back to the nearest score line and cut bituminous concrete pavement back far enough to prevent disturbance to base course materials. Pavements damaged as a result of Contractor activities shall be replaced to the extent determined by the Engineer at no additional cost to the Owner.

1.04 RELATED WORK:

A. Section 02051- ASBESTOS ABATEMENT
B. Section 13282- LEAD BASED COATINGS REMOVAL
C. Section 01570- ENVIRONMENTAL PROTECTION
D. Section 01562- DUST CONTROL

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Submit six (6) copies of a demolition plan and schedule, for each site, to the Engineer for review at least two weeks prior to the start of work, describing the proposed sequence, methods, and equipment required for the demolition and disposal. Identifying recycling and disposal facilities, with applicable permits, for each waste stream. Also, indicate measures to be taken to protect adjacent properties and all adjacent facilities to remain.

B. Do not proceed with the demolition until the Engineer has given written acceptance of the demolition plan.

C. Evidence of lawful disposal or recycling of all wastes generated, including waste shipment manifests, shipping records, and weight slips shall be submitted and up to date with each request for payment. Requests for payment will be returned, in the event that this requirement is not met..

PART 2 - PRODUCTS

2.01 TEMPORARY FENCE:

A. The work under these Items shall conform to the relevant provisions of section 644 of the MassDOT standard specifications.

B. The work shall include temporary installation of chain link fence around the perimeter of the work limits where shown on the plans, and as required by the Engineer, and as Contractor sees fit to protect work.

C. Temporary fence shall consist of 6 foot high chain link fence anchored into a base that is both stable and movable to allow access and adjustment as needed. Reclaimed existing fence fabric and materials may be used with the approval of the Engineer. The Contractor shall submit a shop drawing to the Engineer for approval prior to installation.

2.02 BACKFILL:

A. The Contractor shall provide suitable backfill as specified under Section 02300 of these Specifications, to fill voids left by removal or abandonment of site features, and shall provide all pipe cap ends, mortar, brick and other material needed to cap off or plug pipes of various sizes and kinds.

B. Suitable materials shall be used as base course fill and topsoil to the depth as specified herein. Restore disturbed areas with similar materials blended to match the line and grades of adjacent surfaces.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Provide, erect, and maintain temporary barriers and security devices. Temporary fence shall be erected and existing chain link fences may be maintained in place throughout the demolition process. Erect temporary chain link construction fencing at as voids are created in the perimeter of the work area (formed by buildings to be demolished.)

B. Notify City of Newton of procedures and operations that may affect the property or adjacent properties, of potential noise, utility outages, or other potential disruptions. Coordinate with City of Newton and Engineer.

C. Protect all existing site features and elements that are to remain or that are to be removed and transported as stipulated elsewhere in the Contract Documents.

D. Arrange with, pay for all required fees, and perform work required by utility companies and municipal departments for discontinuance or interruptions of utility services due to demolition work.

E. Arrange with, pay for all required fees, and perform work required by municipal departments for interruptions of road/sidewalk access due to demolition work. Fees associated with any required police details shall also be the responsibility of the contractor.

3.02 DEMOLITION REQUIREMENTS:

A. The demolition of the buildings, site features, utilities and related appurtenances shall be accomplished by methods that will not cause damage to surrounding structures, underground and overhead utilities, or other existing items and structures that are to remain in place.

B. Under no circumstances shall explosives be used.

C. Conduct operations with minimum interference to public or private properties and access routes. Gain access to the premises at designated locations only.

D. Maintain protected access and egress at all times. Do not close or obstruct roadways without permits.

E. Cease operations immediately if adjacent properties or facilities appear to be in danger. Notify the City of Newton for direction prior to commencing with work.

F. Restore all disturbed areas outside the demolition areas to original conditions, remove and replace all elements that are intended to remain, but have been damaged to the satisfaction of the City of Newton.

G. There are known asbestos containing materials (ACM) and other hazardous materials in the site buildings. See Section 02051 – ASBESTOS ABATEMENT and Section 13282 – LEAD BASED COATINGS REMOVAL for additional information

3.03 BUILDING DEMOLITION:

A. Identify, disconnect, cap, and remove designated utilities to each building and/or structure. Coordinate with all Utility representatives and pay all fees associated with all work.

B. Demolish components indicated, in an orderly and careful manner. Note that unless specifically authorized otherwise, all demolished materials shall be removed from the premises and disposed of or recycled in a lawful manner. Provide evidence of satisfactory disposal or recycling.

C. Remove all concrete slabs and footings, complete, as noted on the Contract Documents.

D. Remove all concrete slabs, foundations, footings and related substructure to full depth as described on the Contract Drawings.

E. Legally dispose of or recycle all materials from demolition as well as equipment and other materials that are within the buildings. The disposal and/or recycling facility(ies) shall be permitted to accept the waste stream by the applicable State Agency. The loading of demolition materials shall be performed in a manner that prevents materials and activities from generating excessive dust and ensure minimum interference with roads, sidewalks and streets both on-site and off-site

F. Backfill foundations and substructure excavations with Class B or Select Backfill. Compact backfill in accordance with Section 02300- EARTHWORK.

G. Rough grade and compact areas affected by demolition to maintain grades and contours per Drawings.

H. Loam and seed per the Contract Drawings and Section 02920 – Loaming and Seeding.

3.04 EROSION AND DUST CONTROL:

A. Erosion and dust control measures will be required during the project to prevent the potential migration of impacted soil/sediment off-site. As part of the general site work, the Contractor shall include environmental protection (straw wattles, etc.), as required, to prevent sediment laden water from leaving the site. The Contractor shall also install and maintain catch basin protection (sediment control fabric) at the surrounding catch basins. Vehicles leaving the site shall have no mud and dirt on the vehicle body or wheels. Any foreign matter on the vehicle body or wheels shall be physically removed prior to the vehicle's entering a public roadway. Contractor shall not permit any truck to leave the site with exterior mud or dirt that has the potential to be deposited on public roadways.

B. The Contractor is responsible for implementing engineering controls to minimize or eliminate fugitive dust emissions at the site. These engineering controls shall be implemented during all demolition and earthwork activities (demolition, stockpiling, excavating, loading, backfilling, grading, and removal of material). If dust exceeds action levels (150 micrograms per cubic meter (µg/m3)), or determined to be a nuisance by the Engineer, the Contractor shall implement additional engineering controls (e.g., additional dust suppression agents, wind screens, wind barriers), as required by the Engineer, at no additional cost to the Owner.

3.05 EXCAVATIONS AND SITE SECURITY:

A. Upon completion of daily work, the Contractor will secure open excavations with steel plates and/or temporary chain link fencing, as appropriate, for public safety. The Contractor shall be responsible for public safety and security within their work zone for the duration of this Project.

3.06 SALVAGEABLE MATERIAL:

A. Frames, grates and other salvageable material shall be carefully removed to minimize damage and stored for later reuse, transport, or removal from site.

3.07 ABANDONED STRUCTURES:

A. All inlets and outlets shall be plugged with at least eight (8) inches of brick and mortar masonry. Upper portions of masonry structures shall be removed to a depth of three feet. The bottoms of all structures shall be broken to allow drainage, and the structure shall be filled with suitable backfill material placed in six (6) inch layers and thoroughly compacted at each level.

B. The Engineer shall review work related to abandoned structures before backfilling. Those items not reviewed before backfilling shall be uncovered and backfill procedures observed, at no expense to the Owner.

3.08 ABANDONED PIPES OR CONDUITS:

A. Plug previously abandoned drainpipes encountered with masonry brick at least eight (8) inches in thickness.

B. Abandon discontinued water supplies that are encountered during the execution of this contract in accordance with Owner requirements.

C. Electrical conduits encountered and previously abandoned shall be capped or plugged.

3.09 CLEAN UP:

A. Remove demolished materials from sites as work progresses. Provide evidence of satisfactory disposal or recycling accommodations for all demolished materials.

B. Leave areas of work in safe and clean condition at the end of each work day.

C. Restore all project areas and adjacent project areas in conformance with the Contract Documents.

END OF SECTION

SECTION 02230

CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall do all required clearing and grubbing as indicated on the drawings or herein specified in the area required for construction operations on the Owner's land or in the Owner's permanent or temporary easements and shall remove all debris resulting therefrom.

B. Unless otherwise noted, all areas to be cleared shall also be grubbed.

C. The Contractor shall not clear and grub outside of the area required for construction operations.

1.02 RELATED WORK:

Any trees and shrubs specifically designated by the Owner not to be cut, removed, destroyed, or trimmed shall be saved from harm and injury in accordance with Section 01570, ENVIRONMENTAL PROTECTION.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION

3.01 RIGHT TO WOOD AND LOGS:

The Owner shall have the right to cut and remove logs and other wood of value in advance of the Contractor's operations. All remaining logs and other wood to be removed in the course of clearing shall become the property of the Contractor.

3.02 CLEARING:

A. Unless otherwise indicated, the Contractor shall cut or otherwise remove all trees, saplings, brush and vines, windfalls, logs and trees lying on the ground, dead trees and stubs more than 1-foot high above the ground surface (but not their stumps), trees which have been partially uprooted by natural or other causes (including their stumps), and other vegetated matter such as shags, sawdust, bark, refuse, and similar materials.

B. Except where clearing is done by uprooting with machinery or where stumps are left longer to facilitate subsequent grubbing operations, trees, stumps, and stubs to be cleared shall be cut as close to the ground as practicable but not more than 6-inches above the ground surface in the case of small trees, and 12-inches in the case of large

trees. Saplings, brush and vines shall be cut as close to flush with the ground as possible.

3.03 GRUBBING:

A. Unless otherwise indicated, the Contractor shall completely remove or grind all stumps and roots to a depth of 18-inches.

B. Any depression remaining from the removal of a stump and not filled in by backfilling shall be filled with gravel borrow and/or loam, whichever is appropriate to the proposed ground surface.

3.04 DISPOSAL:

All material collected in the course of the clearing and grubbing, which is not to remain, shall be disposed of in a satisfactory manner away from the site or as otherwise approved. Such disposal shall be carried on as promptly as possible and shall not be left until the final clean-up period.

END OF SECTION

SECTION 02232

SELECTIVE CLEARING, PRUNING, AND INVASIVE SPECIES REMOVAL

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The work of this Section includes the following:

1. Removal of trees and other vegetation as indicated on the drawings.

2. Removal of invasive species and undesirable undergrowth in accordance with these specifications and as indicated on the drawings.

3. Pruning of existing trees and shrubs along proposed park edges, fence lines, pathways, trail corridors and other designated locations, or as directed by the Engineer.

4. Stump removals to 18” below prevailing grades.

B. Refer to the Contract Drawings for the general quantity and locations of existing trees and undergrowth that require pruning or removal. Plant material shall be pruned in conformance with this specification. Plant removals shall be limited to areas as denoted on the plans and shall include the removal of individual trees that would impede the construction of proposed facilities or those that are dead or dying as determined by a certified arborist.

C. Prospective bidders are required to complete a site visit to review the extent of work required and to confirm existing conditions, access issues, terrain and the general nature of the work of the Section.

1.02 QUALIFICATIONS OF CONTRACTOR:

A. This work shall be limited to individuals, partnerships and corporations who are actively engaged in the field of Arboriculture, and who demonstrate competence, experience and financial capability to carry out the terms of this project. Eligible contractors must derive a majority of their income from arboricultural work. The Owner may require proof of these qualifications.

B. All work shall be conducted by qualified and trained personnel under the direct supervision of a Massachusetts Certified Arborist (MCA) in the Contractor's employ.

1.03 PERSONNEL:

A. The Contractor shall submit each employee's name and title prior to the commencement of work. The Contractor shall advise the Owner of any changes in personnel assigned to this contract.

B. A crew shall consist of one (1) tree trimmer/climber, and one (1) ground person (one of whom shall be a crew foreman). The crew foreman shall have a minimum of five (5) years climbing/pruning experience. At least one (1) crew person shall be an MCA and shall be certified in CPR.

C. Each trimmer shall be experienced and highly qualified with the necessary tree worker skills to successfully complete the work of this Section, including the ability and training to perform aerial rescue. Said skill shall also include worker safety and ability in compliance with current OSHA and ANSI Z-133.1 Standards.

1.04 SPECIAL REQUIREMENTS:

A. Trees: The trees to be removed shall be those shown on the plans or designated by the Engineer/Arborist. The Arborist shall be advise on selecting clearing of limbs and undergrowth, and shall identify invasive species to be removed in the areas designated on the plans.

B. Invasive Species: The Arborist shall identify invasive species to be removed in the areas designated on the plans. Invasive plants species shall be removed using common practices for specific species. Invasive plant species removal shall focus on, but shall not be limited to, the following species:

1. Japanese Knotweed (*Fallopia japonica)*

2. Other invasive species identified by the Engineer/Arborist for removal.

C. Undergrowth: All plants less than 4 inches in diameter, measured at a height of 4 feet 6 inches above the ground, shall be classified as undergrowth. All undergrowth shall be removed from areas shown on the plans, described in the special provisions, or designated by the Engineer; except for those plants designated by the Engineer to be preserved.

D. Dutch Elm diseased wood shall be disposed of in accordance with provisions of General Laws, Chapter 87, Section 5, and Chapter 132, Sections 8 and 11 as amended; and in accordance with any additional local regulations. All wood shall be removed from the site and be properly disposed of in accordance with state and local regulations.

E. No burning shall be permitted on the project site.

F. Prior to commencing work, the Contractor shall submit a plan to the Owner for legal disposal of removed materials, in conformance with State and Federal regulations.

1.05 STANDARDS AND DEFINITIONS:

A. All pruning work shall conform to the following:

1. The ANSI A300 'Standard Practices for Trees, Shrubs, and Other Wood Plant Materials' of the Secretariat: National Arborist Association, Post Office Box 1094, Amherst, New Hampshire 03031.

2. American National Standards Institute (ANSI) Standard Z-133.1.

B. The term 'Owner' shall mean the Owner's designated representative charged with carrying out the requirements of this Project –'Landscape Architect', 'Arborist', 'Engineer', 'Planner', or 'Tree Warden' as referenced herein, rendering approvals for the Owner.

C. The Engineer will monitor job progress throughout the project and approve all payments. A site walk will be conducted before work begins between the Contractor and the Engineer. Specific trees, undergrowth and invasive species may be identified at this time for removal/eradication.

1.06 EXAMINATION OF SITE AND DOCUMENTS:

A. The Contractor shall be responsible for having a clear understanding of the existing site conditions and shall be responsible for fully carrying out the work of this Section, regardless of actual site conditions encountered.

1.07 ORDER OF WORK:

A. Based on the site conference, the Contractor shall submit a schedule of work for the Owner's review and approval prior to beginning work. Unless otherwise authorized by the Owner, failure of the Contractor to comply with the approved removal schedule shall be sufficient cause to give notice that the Contractor is in default of the contract.

1.08 PROTECTION OF THE VEGETATION TO BE PRESERVED:

A. The Contractor shall protect all existing trees, shrubs, lawns and other site features designated to remain. The placement of protection devices, such as snow fence enclosures, shall, however, be at the Contractor's discretion.

B. Damage no plant to remain by burning, pumping water, cutting of live roots or branches, or any other means. Neither vehicles nor equipment shall be parked within the dripline of trees to remain, or where ever damage may result to trees to be saved. Construction material shall not be stored beneath trees to be saved.

C. The Contractor shall be liable for any damage to any trees, shrub, lawn or other features to remain, and shall immediately report to the Owner. Damaged shrubs or lawns shall be restored or replaced to match existing to remain to the satisfaction of the Owner.

D. The Contractor shall compensate the Owner for damages by installing replacement tree(s) of the size and species approved by the Owner and of sufficient quantity such that the sum of the caliper inches for replacement trees equals the total caliper inches of the damaged tree(s). Damaged shrubs shall be replaced with shrubs(s) of the same size, species, and quantity, unless determined otherwise by the Owner.

E. Any plants that are damaged to such an extent as to destroy their value for landscape purposes shall be cut and disposed of, and grass that is damaged shall be reseeded and remulched as necessary by the Contractor at no cost to the Owner when so required by the Engineer.

F. The Contractor shall conduct his operations in such a manner to prevent injury to trees, shrubs, grass, or other types of vegetation that are to remain growing, and also to prevent damage to adjacent property.

G. When any such injuries to trees or shrubs occur, broken branches shall be removed and rough edges of scarred areas shaped and made smooth in accordance with generally accepted horticultural practice.

1.09 USE AND CARE OF THE SITE:

A. The Contractor shall leave the work site at the end of each working period in a condition satisfactory to the Owner.

B. Pavements shall be swept and lawns or other surfaces raked and/or otherwise cleaned of all materials related to the work operation. Degree of clean-up required will be described by the Owner and will be based upon the character of the work area.

C. All trimmings or any other form of debris (except diseased materials or trimmings from Elms) shall be collected and chipped, or reused in wetland replication area as indicated in the drawings. The Contractor shall remove all materials and shall dispose of such materials off site in a legal manner.

D. The Contractor shall be fully and solely responsible for any damage to equipment or vehicles left at the site of the work. All necessary permits shall be obtained by the Contractor.

PART 2 - PRODUCTS

2.01 EQUIPMENT:

A. Equipment necessary for this Contract shall be properly maintained and in good operating condition to the Owner's satisfaction. The Contractor shall promptly remove and replace any equipment which the Owner deems to be in unsatisfactory condition or otherwise unsuitable. All equipment must be Low Ground Pressure (LGP) machines per Section 01110 Control of Work and Materials.

B. A disc chipper shall be used which will process material up to twelve (12) inches in diameter.

PART 3 - EXECUTION

3.01 TREE PRUNING:

A. Under this Section, the Contractor shall furnish all labor, materials, equipment and transportation required to complete all aspects of the work in accordance with all local, state and federal regulations in force at the same time of this contract and in accordance with tree pruning as specified herein.

B. The work of this Section consists of all tree pruning work and related items as specified herein and includes, but is not limited to:

1. Pruning throughout the designated areas and limb removal required to allow for the proper installation of all proposed improvements. Medium pruning efforts shall consist of the removal of dead, dying, diseased, interfering, objectionable and weak branches on the main trunks as well as those within the leaf area. An occasional branch one (1) inch or less in diameter may remain within the main leaf area where it is not practical to remove it.

3.02 TREE PRUNING DESCRIPTION OF WORK:

A. Tree Pruning and trimming are generally described as the removal and disposal of limbs, branches and stubs which are either dead, potentially detrimental to the health of the tree or dangerous to pedestrians, visually deficient, interfering or otherwise objectionable as determined by the Owner.

B. The limits of all trees to be pruned have been identified on the plans or referenced elsewhere in this specification section.

C. Vehicle access shall be controlled and approved by the Owner.

D. If the Contractor discovers tree(s) which have not been designated for removal, but whose condition is such that removal is warranted, whether due to death, disease, decay, or structural weakness, such tree(s) shall not be pruned and the Contractor shall immediately report these findings in writing to the Owner and await the Owner's direction before proceeding with work on the particular tree(s) in question.

E. All tree pruning shall be conducted in a manner that maintains the natural aesthetic characteristics of the species and variety of trees. No topping or dehorning of trees or stubbing back of branches shall be permitted. All cuts shall be made to a lateral branch that is a minimum of one-third (1/3) the size of the branch being removed, unless otherwise instructed by the Owner.

F. The use of climbing spurs or spiked shoes shall not be permitted and their use will result in the immediate cancellation of the contract.

G. All cuts shall be made sufficiently close to the parent stem so that wound closure can be readily started under normal conditions. Cuts shall, however, never be made through the branch collar. Slab cuts and rip cuts will result in cancellation of the contract.

H. All limbs over two (2) inches in diameter to be removed shall be precut to prevent splitting. Any branches that by falling would injure existing trees to remain or other objects shall be lowered to the ground by proper ropes.

I. On trees known to be diseased and where there is known to be danger of transmitting the disease on tools, tools shall be disinfected with alcohol after each cut between trees.

J. Lateral branches as well as occasional branch suckers may be retained. Complete removal of secondary laterals and branch suckers resulting in the stripping of major limbs, ("lion tailing") will not be permitted.

K. All branches and limbs shall be manually lowered to the ground via rope and pulley. This practice must be consistent with the National Arborist Association Standards for Pruning. All grade-level artifacts and landscaping must be protected from damage.

3.03 REMOVALS:

A. The Contractor shall furnish all labor, materials, equipment and transportation required to complete all aspects of the removals work in accordance with all local, state, and federal regulations in force at the time of this contract and in accordance with tree and stump removals as specified herein.

3.04 REMOVALS DESCRIPTION OF WORK:

A. Removal is generally described as the removal of groups and individual trees and shrubs which interfere with the growth of more desirable types of trees; the clearing away of lesser growth that may obscure outstanding trees; and thinning out to provide space for healthy growth by the elimination of thinner, weaker trees.

B. For the purposes of this contract, removals shall also include all species that are dead, dying, or diseased, are undesirable or are considered to be invasive, as recognized by applicable entities of the Commonwealth of Massachusetts and Massachusetts Association of Arborists.

C. The Contractor shall adhere to the specifications and provide suitable facilities for inspecting the work. Failure of the Owner to immediately reject unsatisfactory work or to notify the Contractor of deviations from the specification shall not relieve the Contractor of responsibility to correct or remedy unsatisfactory work.

D. The Contractor shall only work on trees as designated by the contract documents and/or the Owner. No compensation will be made for work performed on any other tree or trees.

E. Trees designated to be removed shall be taken down and all leaves, branches and trunks of trees properly disposed of by chipping and removal from the premises.

F. Fell trees in a manner that allows all site features and those trees to be saved undamaged.

G. Removal of all the parts of each tree shall be completed on the same day that the tree is cut.

H. Stumps of trees removed shall also be removed to eighteen (18) inches below grade by grinding or other means acceptable to the Owner. The void from the stump removal operations shall be filled with ordinary borrow soil to within six (6) inches of finished grade. The top six (6) inches shall be filled with screened loam, moderately tamped to prevent future settling. In grass areas, the disturbed area shall be sown with grass seed of a mix appropriate to the location, as directed by the Owner.

I. Excavation or grading within the branch spread of trees to be saved shall be performed only under the direction of the Owner unless otherwise required.

J. All equipment to be used and all work to be performed must be in full compliance with all standards as promulgated by OSHA at the time of bidding, including, but not limited to those regulations concerning noise levels, protective devices and operator safety.

K. The Contractor shall be solely responsible for pedestrian and vehicular safety and control within the work site and shall protect the public and its property from injury or damage that could be caused by the progress of the work. To this end the Contractor shall provide, erect, and maintain protective devices acceptable to the Owner, including but not limited to barricades, lights and warning signs.

L. Any practice employed by the Contractor that is obviously hazardous as determined by the Owner shall be immediately discontinued by the Contractor upon receipt of either written or oral notice from the Owner to discontinue such practice.

3.05 SELECTIVE CLEARING AND INVASIVE SPECIES REMOVAL:

A. If invasive species are found at the replication site, all plant material including root mass, stolons, and rhizomes will be removed to prevent re-sprouting from occurring. This will occur using hand tools. The vegetation will be placed inside large plastic bags so seeds do not spread to any non-impacted areas.

B. When leaving the work area, all equipment and clothing used during removal shall be cleaned to remove seed material before entering non-impacted areas

3.06 DESCRIPTION OF WORK-SELECTIVE CLEARING AND INVASIVE SPECIES REMOVAL:

A. As applicable, any part of tree trunks or base of plant material located on the Limit of Work line, as shown on the drawings, shall be considered within the Limit of Work.

B. The Contractor's attention is called to the requirements for work under this item. The desired appearance to be attained in certain areas of heavy growth may require three or more operations. First, the obvious dead, dying and diseased trees and undergrowth shall be cut and cleared out of the area. This work includes removal of any previously fallen trees, branches, uprooted stumps and other debris as directed. Next, the area is to be thinned out, as directed, by removing the less desirable trees and brush which interfere with the growth of the better plant material. Finally, clear out lesser growth which may obscure outstanding trees, tree groups or scenic views.

C. Tree up-branching and shaping under this item will be restricted to trees which have limbs and branches restricting sight distance, extending over roadways, shoulders, turn outs, etc. Up-branching or trimming will be required to produce a 6 meter minimum vertical clearance over all locations described hereinbefore, and the removal of limbs and branches involved in this operation shall be accomplished as outlined hereafter.

D. Debris created from selective clearing and pruning operations occurring within wooded areas, provided plant material is native and does not exhibit evidence disease or pests, may be scattered and spread along the sides of the proposed trail. Debris shall not be piled and shall not alter the natural drainage patterns of the area.

END OF SECTION

SECTION 02240

DEWATERING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section specifies designing, furnishing, installing, maintaining, operating and removing temporary dewatering systems as required to lower and control water levels and hydrostatic pressures during construction; disposing of pumped water; constructing, maintaining, observing and, except where indicated or required to remain in place, removing of equipment and instrumentation for control of the system.

B. Test pit information are attached at the end of Section 02300, EARTHWORK

1.02 RELATED WORK:

A. Section 01570, ENVIRONMENTAL PROTECTION

B. Section 02300, EARTHWORK

C. Section 02252, SUPPORT OF EXCAVATION

1.03 SYSTEM DESCRIPTION:

A. Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from the slopes or bottom of the excavation; increasing the stability of excavated slopes; preventing loss of material from beneath the slopes or bottom of the excavation; reducing lateral loads on sheeting and bracing; improving the excavation and hauling characteristics of sandy soil; preventing rupture or heaving of the bottom of any excavation; and disposing of pumped water.

B. Normal dewatering is defined as using conventional pumps installed in open excavations, ditches, or sumps.

1.04 QUALITY ASSURANCE:

A. The Contractor is responsible for the adequacy of the dewatering systems.

B. The dewatering systems shall be capable of effectively reducing the hydrostatic pressure and lowering the groundwater levels to a minimum of 2 feet below excavation bottom, unless otherwise required by the Engineer, so that all excavation bottoms are firm and dry.

C. The dewatering system shall be capable of maintaining a dry and stable subgrade until the structures, pipes and appurtenances to be built therein have been completed to the extent

that they will not be floated or otherwise damaged.

D. The dewatering system and excavation support (see Section 02252, SUPPORT OF EXCAVATION) shall be designed so that lowering of the groundwater level outside the excavation does not adversely affect adjacent structures, utilities or wells.

1.05 SUBMITTALS

A. Contractor shall submit a plan indicating how they intend to control the discharge from any dewatering operations on the project, whether it is discharge of groundwater from excavations or Stormwater runoff during the life of the project.

PART 2 - EXECUTION

2.01 DEWATERING OPERATIONS:

A. All water pumped or drained from the work shall be disposed of in a manner which will not result in undue interference with other work or damage to adjacent properties, pavements and other surfaces, buildings, structures and utilities. Suitable temporary pipes, flumes or channels shall be provided for water that may flow along or across the site of the work. All disposal of pumped water shall conform to the requirements of the owner.

B. Dewatering facilities shall be located where they will not interfere with utilities and construction work to be done by others.

C. Dewatering procedures to be used shall be as described below:

1. Crushed stone shall encapsulate the suction end of the pump to aid in minimizing the amount of silt discharged.

2. For dewatering operations with relatively minor flows, pump discharges shall be directed into hay bale sedimentation traps lined with filter fabric. Water is to be filtered through the hay bales and filter fabric prior to being allowed to seep out into its natural water course.

3. For dewatering operations with larger flows, pump discharges shall be into a steel dewatering basin. Steel baffle plates shall in used to slow water velocities to increase the contact time and allow adequate settlement of sediment prior to discharge into waterways.

4. Where indicated on the contract drawings or in conditions of excess silt suspended in the discharge water, silt control bags are to be utilized in catch basins.

5. The Contractor shall be responsible for repair of any damage caused by his dewatering operations, at no cost to the Owner.

END OF SECTION

SECTION 02252

SUPPORT OF EXCAVATION

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section of the specification covers wood sheeting and bracing for support of excavations. The requirements of this section shall also apply, as appropriate, to other methods of excavation support and underpinning which the Contractor elects to use to complete the work.

B. The Contractor shall furnish and place timber sheeting of the kinds and dimensions required, complying with these specifications, where indicated on the drawings or required by the Engineer.

1.02 RELATED WORK:

A. Section 02240, DEWATERING.

B. Section 02300, EARTHWORK.

1.03 QUALITY ASSURANCE:

A. This project is subject to the Safety and Health regulations of the U.S. Department of Labor set forth in 29 CFR, Part 1926, and to the Massachusetts Department of Safety and Department of Labor, Division of Occupational Safety "Excavation & Trench Safety Regulation (520 CMR 14.00)" and "Rules and Regulations for the Prevention of Accidents in Construction Operations (454 CMR 10.0 et seq.)." Contractors shall be familiar with the requirements of these regulations.

B. The excavation support system shall be of sufficient strength and be provided with adequate bracing to support all loads to which it will be subjected. The excavation support system shall be designed to prevent any movement of earth that would diminish the width of the excavation or damage or endanger adjacent structures.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Timber sheeting shall be sound spruce, pine, or hemlock, planed on one side and either tongue and grooved or splined. Timber sheeting shall not be less than nominal 2-inches thick.

B. Timber and steel used for bracing shall be of such size and strength as required in the excavation support design. Timber or steel used for bracing shall be new or undamaged

used material which does not contain splices, cutouts, patches, or other alterations which would impair its integrity or strength.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Work shall not be started until all materials and equipment necessary for their construction are either on the site of the work or satisfactorily available for immediate use as required.

B. The sheeting shall be securely and satisfactorily braced to withstand all pressures to which it may be subjected and be sufficiently tight to minimize lowering of the groundwater level outside the excavation, as required in Section 02240, DEWATERING.

C. The sheeting shall be driven by approved means to the design elevation. No sheeting may be left so as to create a possible hazard to safety of the public or a hindrance to traffic of any kind.

D. If boulders or very dense soils are encountered, making it impractical to drive a section to the desired depth, the section shall, as required, be cut off.

E. The sheeting shall be left in place where indicated on the drawings or required by the Engineer in writing. At all other locations, the sheeting may be left in place or salvaged at the option of the Contractor. Steel or wood sheeting permanently left in place shall be cut off at a depth of not less than two feet below finish grade unless otherwise required.

F. All cut-off will become the property of the Contractor and shall be removed by him from the site.

G. Responsibility for the satisfactory construction and maintenance of the excavation support system, complete in place, shall rest with the Contractor. Any work done, including incidental construction, which is not acceptable for the intended purpose shall be either repaired or removed and reconstructed by the Contractor at his expense.

H. The Contractor shall be solely responsible for repairing all damage associated with installation, performance, and removal of the excavation support system.

END OF SECTION

SECTION 02290

SEEDING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section includes furnishing all labor, materials, equipment, seed and incidental materials necessary to accomplish all grass seeding and related work, complete in place, maintained, and accepted, in accordance with the Contact Drawings and Specifications. All grassed areas disturbed by the Contractor's operations shall be repaired as herein specified.

B. The Contractor shall bear the responsibility and cost of furnishing and applying water or any other substances, as necessary to ensure the sustainability of grass seeded areas, as part of the work of this contract.

1.02 RELATED WORK:

A. Section 02910, SCREENED LOAM BORROW AND TOPSOIL REUSED.
B. Section 02911, ROOT ZONE MIX FOR BALLFIELDS

1.03 SUBMITTALS:

In accordance with requirements of general specifications, the Contractor shall submit the following to the Engineer for review and approval:

A. Six copies of information for seed mixes including the following:

1. Name and address of the seed supplier.

2. Source of origin and dates of harvest for each of the various types of seed

3. Certification of seed mix composition and proportion, indicating named seed varieties by percent, percent germination, purity, and percent crop seed, percent inert matter, and percent weed seed content.

4. Estimated number of seeds per pound of each type of seed in the mix

5. Ingredients that comprise the hydroseed mix

6. Soil amendments and fertilizers and indicated in Appendix E – Sand and Soil Amendments

B. Six copies of information detailing proposed limestone, fertilizers, mulch materials, hydroseeding materials (as required), and slope protection material (as required) to be applied to seeded areas.

C. Six copies of watering, fertilizing and maintenance schedule.

D. Six copies of marked up prints indicating the square footage of all proposed seeded areas with quantities of various soil additives and amendments, and quantities of seed for each area prior to beginning work.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LOAM BORROW;

1. Loam Borrow shall be as specified in Section 02910, SCREENED LOAM BORROW AND TOPSOIL RE-USED.

B. LIMESTONE:

1. Lime shall be an approved agricultural limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide). The material will be ground such that 50 percent of the material will pass through a No. 100 mesh sieve and 98 percent will pass a No. 2 mesh sieve. Lime shall be uniform in composition, dry and free-flowing and shall be delivered to the site in the original sealed containers, each bearing the manufacturer's guaranteed analysis.

C. FERTILIZER:

1. Fertilizer shall be a complete, standard commercial fertilizer, homogenous and uniform in composition, dry and free-flowing, and shall be delivered to the site in the manufacturer's original sealed containers, each bearing the manufacturer's guaranteed analysis and marketed in compliance with State and Federal Laws. All fertilizer shall be used in accordance with the manufacturer's recommendations. Refer to Appendix E – Sand and Soil Amendments for required fertilizers. All fertilizers and soil amendments shall meet these requirements or be an approved equal.

2. Refer to Appendix E – Sand and Soil Amendments for required fertilization requirements.

D. SEED:

1. Seed shall be of an approved perennial variety mixture, the previous year's crop, clean, and high in germinating value. Weed seed content shall be less than 0.5 percent and include no noxious weeds. Seed shall be obtained from a reliable seed company and shall be accompanied by certificates of compliance relative to mixture

purity and germinating value. Seed shall be furnished and delivered in new, clean, sealed and properly labeled containers. All seed shall comply with applicable State and Federal laws. Seed that has become wet, moldy or otherwise damaged shall not be accepted.

2. Grass seed for playing field areas shall conform to the following requirements: TOUCHDOWN 80/20 MIX or approved equal.

Botanical and Common Names	Proportion by Weight	Germination Rate	Purity Minimum
Touchdown Kentucky Bluegrass	30%	70%	97%
Mercury Kentucky Bluegrass	30%	90%	98%
Armada Bluegrass	20%	80%	85%
Futura 3000 Ryegrass Blend	20%	90%	98%
Refer to Appendix E – for technical information on the seed types			

3. Grass seed for general lawn areas shall conform to the following requirements:

Botanical and Common Names	Proportion by Weight	Germination Rate	Purity Minimum
Chewing's Fescue (Festuca rubra commutata)	30%	70%	97%
'Kentucky 31' Tall Fescue (Festuca arundinacea 'Kentucky 31')	30%	90%	98%
Kentucky Bluegrass (Poa pratensis)	20%	80%	85%
Perennial Ryegrass (Lolium perenne)	20%	90%	98%

G. MULCH

1. Materials to be used in mulching seeded areas shall be free of weed seed and shall conform to the following requirements:

   a. Hay Mulch shall consist of mowed and properly cured grass, clover or other acceptable plants. No salt hay shall be used.

b. Straw Mulch shall consist of stalks or stems of grain after threshing.

H. HYDROSEED MULCH, TACKIFIERS AND WATER RETENTION AGENTS:

1. Wood fiber mulch for Hydroseed application shall be a manufactured product of natural wood cellulose fibers with a non-toxic green marking dye incorporated to ensure uniform distribution. Mulch shall be packed in sealed original containers, clearly labeled with brand name and manufacturer. It shall have delivered moisture content less than 12 percent.

2. Hydroseed tackifier shall be a powdered starch-based product approved by the Engineer. Hydroseed tackifier shall be applied in conjunction with the hydroseed slurry in accordance with the manufacturer's recommendations.

1. Moisture retention agent shall be a powdered starch-based product, approved by the Engineer, and shall be capable of retaining up to 400 times their weight in water. Moisture retaining agents shall be added to the hydroseed slurry in accordance with the manufacturer's recommendations. Moisture retention agent shall be 'Hydro-Gel', as manufactured by Finn Corporation, Fairfield, OH.

3. Contractor to submit mix ingredients prior to installation of hydroseed.

I. SLOPE EROSION PROTECTION:

1. Erosion control blanket shall be 100 percent biodegradable mesh with 100 percent biodegradable straw or straw/coconut fill. Fill shall be held together by biodegradable fastening. Weight shall be 0.50 pounds per square yard. Erosion control blankets shall be applied parallel to direction of water flow. The erosion control blankets shall be by North American Green, Evansville, IN or approved equal. For slopes 4:1 or greater, erosion control blanket shall be composed of 70 percent straw 30 percent coconut fiber, Model SC150. For slopes less than 4:1, erosion control blanket shall be high velocity straw matting, Model S150.

2. Six-inch wire staples shall be placed in accordance with the manufacturer's recommendations to anchor the mesh material. Staples shall be biodegradable.

J. WATER:

1. Water shall be furnished by the Contractor, unless otherwise specified, and shall be suitable for irrigation and free from ingredients harmful to plant growth and viability. The delivery and distribution equipment required for the application of water shall be the furnished by the Contractor, at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 GENERAL:

A. All work shall be performed by skilled workers with a minimum of 2 years of seeded lawn construction and establishment experience and under the full-time supervision of a qualified foreman.

B. Seeding operations shall not begin less than 4 days after the application of lime and fertilizer and the seedbed areas are reviewed and approved by the Engineer.

C. Seeding shall be done when soil and weather conditions permit in early spring, until June 15, or from September 10 to October l5, unless otherwise approved. If it becomes necessary for seed to be sown after June 15, provisions shall be made for supplementary water and using mulch cover over lawn areas.

D. If there is a delay in seeding, during which weeds grow, or soil is washed out, the Contractor shall eliminate the weeds by physical means, or replace the soil before sowing the seed, without additional compensation. Immediately before seeding is begun, the soil shall be lightly raked.

E. Seed shall be sown at the approved rate, on a non-windy day by machine, or as approved by the Engineer.

F. The surface shall be kept moist by a fine spray until the seed shows uniform germination over the entire area. Wherever poor germination occurs in areas larger than 3 square feet, the Contractor shall reseed, roll, straw and water as necessary to obtain proper germination.

G. If there is insufficient time in the planting season to complete soil preparations, fertilizing, and seeding, permanent seeding may be left until the following planting season, at the option of the Contractor, or on order of the Engineer. In that event, a temporary cover crop shall be sown. This cover crop shall be cut and watered as necessary until the beginning of the following planting season, at which time it shall be plowed or harrowed into the soil, the area shall be fertilized and the permanent seed crop shall be sown as specified.

H. Protection of all newly loamed and graded areas is required and shall be accomplished by whatever means necessary such as mulch applied with a tackifier, or by other means approved by the Engineer. The Contractor shall be responsible for the prevention of siltation in areas beyond the limit of work and for all means of protection throughout the maintenance period at no additional cost to the Owner.

3.02 ROOT ZONE MIX TESTING REQUIREMENTS

A. Root zone mix (vegetative support layer) samples shall be collected from in-place loam at a minimum of every 1000 cubic yards and analyzed for grain size (ASTM D422), pH (Astm D6276) and organic content (ignition test).

3.02 SURFACE PREPARATION:

A. Refer to SECTION 02911 – ROOT ZONE MIX FOR BALL FIELDS and Appendix E – Sand and Soil Amendments for surface preparation.

3.03 BROADCAST SEEDING, PLACING MULCH AND SLOPE EROSION PROTECTION:

A. The seed mix shall be broadcast at 6 pounds per 1000 square feet, as recommended by the seed supplier, or as directed by the Engineer. Seed shall be divided into 2 equal amounts and uniformly distributed in 2 applications at right angles to each other. Seed shall then be raked lightly into the soil to a depth of l/4 inch.

B. If mulch is not necessary the seed shall be directly firmed into the soil with a roller that will apply pressure between 75 and 100 pounds per linear foot of width.

C. Hay or Straw Mulch shall be used based on time of seeding as previously specified over all seeded areas, as designated on the plans, or as otherwise directed. If mulch is to be used, it shall be loosely spread to a uniform depth at a rate of 4-1/2 tons per acre to provide ¼ inch of cover, or as otherwise directed. The seed and mulch shall then be firmed into the soil with a roller that will apply a pressure between 75 and 100 pounds per foot of width.

D. Hay or Straw Mulch may be applied by mechanical apparatus, if in the judgment of the Engineer, the apparatus spreads the mulch uniformly and forms a suitable mat to control slope erosion. The apparatus shall be capable of spreading at least 80 percent of the hay or straw in lengths of 6-inches or more, otherwise it shall be spread by hand without additional compensation.

E. Slope erosion control blankets shall be placed as indicated on the plans or as directed by the Engineer.

3.04 HYDROSEEDING:

A. The application of lime, fertilizer, grass seed and mulch may be accomplished in a single operation with the use of approved hydroseeding equipment. The materials shall be mixed with water in the machine and kept in an agitated state in order that the materials may be uniformly suspended in the water. The slurry shall be of such consistency that it can be sprayed from a hydroseed gun or through at least 200 feet of 1 ½ inch diameter hose. The spraying equipment shall be so designed that when the solution is sprayed over an area, the resulting deposits of lime, fertilizer, grass seed, and mulch shall be equal to the specified quantities.

B. Prior to the start of hydroseeding, the Contractor shall furnish to the Engineer, in writing, the weights of limestone, fertilizer, grass seed, mulch, tackifier (as required) and moisture retention agent (as required) per 100 gallons of water to be used. This statement should also specify the number of square yards of seeding that can be covered with the solution specified above. If the results of hydroseeding operations are unsatisfactory, the Contractor will be required to abandon this method and to apply the lime, fertilizer, grass seed and mulch by other means.

C. Seed shall be incorporated with the mulching material to obtain a minimum hydroseeded sown coverage of 200 pounds of the specified seed mix per acre, as recommended by the seed suppliers, or as directed by the Engineer.

D. Wood fiber mulch shall be uniformly spread over certain selected seeded areas at the minimum rate of 1,400 pounds per acre unless otherwise directed. Mulch shall be placed by spraying from an approved spraying machine with pressure sufficient to cover the entire area in a single operation.

E. The Contractor shall immediately cleanup hydroseed oversprays from plant materials, pavements, furnishings, etc., to the satisfaction of the Engineer.

3.05 MAINTENANCE:

A. The Contractor shall maintain and protect the entire seeded area, as necessary to ensure dense healthy growth, until completion of the guarantee period and final acceptance of the project, or for 60 days, whichever is longer. If lawns are planted in late summer or during the fall, maintenance shall continue through the following spring for at least 60 days. Maintenance shall include watering as specified, liming, fertilizing, removal of stones, control of weeds, insect pests and fungal pathogens, and regular mowing. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit.

B. The first cutting of lawn areas shall be done when the grass is between 2 ½ - 3 inches in height. The lawn shall be cut no shorter than 2 inches in height and shall be regularly mowed as necessary to maintain the above-prescribed conditions. All cuttings shall be removed from the lawn during the maintenance period and disposed of off-site. Cutting shall be accomplished with approved equipment that is weed free, clean of all herbicides and pesticides and has freshly sharpened blades. No mowing shall occur without inspection and approval of the owner or Engineer.

C. The Contractor shall be responsible to regularly water seeded areas with the equivalent of 1-inch minimum of rainfall per week, or as necessary to develop and sustain dense, green growth.

D. Six weeks after turf has established, and only during the months of April, May, or September, the Contractor shall apply fertilizer as specified above, at one half the rate recommended by the initial soils laboratory tests, or as directed by the Engineer.

E. The Contractor shall be responsible for securing all seeded areas from physical damage as necessary, including warning signs, barriers, temporary fencing, or other means of protection, through the guarantee period until final acceptance. All damaged areas shall be repaired to reestablish healthy vigorous growth of turf to the satisfaction of the Engineer, at no additional cost to the Owner. All temporary barriers shall remain the property of the Contractor and shall be removed by the Contractor upon final acceptance by the Engineer.

F. Pavement shall be kept clean and clear of cuttings and debris at all times during the maintenance period to the satisfaction of the Engineer.

3.06 INSPECTION AND PRELIMINARY ACCEPTANCE:

A. At the beginning of the planting season following that in which the permanent grass crop is sown, seeded areas will be inspected. Any section not showing dense, vigorous growth shall be promptly reseeded by the Contractor at no additional cost to the Owner. The seeded areas shall be watered, weeded, cut and otherwise maintained by the Contractor, as many times as necessary, in accordance with these specifications, until they are accepted.

B. The Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of inspection for preliminary acceptance. The Engineer shall recommend preliminary acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals, or replacements.

C. Inspection and acceptance of seeded areas may be requested and granted in part, provided the areas for which acceptance is requested are relatively substantial in size, and with clearly definable boundaries. Acceptance and use of these areas by the Owner shall not waive any other provisions of this Contract.

D. Refer to Appendix – Sand and Soil Amendments.

3.07 GUARANTEE:

A. Seeded areas shall be guaranteed until final acceptance of the project, or, in the case of late summer or fall planting, the guarantee period shall extend through the following spring.

B. When the work is accepted in part, the guarantee period shall extend from each partial acceptance to the terminal date of the last guarantee period. All guarantee periods terminate at one time.

C. Guarantee shall not apply to the replacement of seeded lawns resulting from the removal, loss, or damage due to occupancy of the project in any part; vandalism or acts of neglect on the part of others; physical damage by animals, vehicles, etc.; and Acts of God, including but not limited to, catastrophic fire, hurricanes, riots, war, etc.

D. In the instance of curtailment of water by local water authorities (when supply was to be furnished by the Owner), the Contractor shall furnish all necessary water by water tanker, the cost of which will be approved and paid for by the Owner.

3.08 FINAL INSPECTION AND FINAL ACCEPTANCE:

A. At the end of the guarantee period, the Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of final inspection for final acceptance.

B. The Engineer shall recommend final acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals or replacements.

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. Under this Section, the Contractor shall furnish all labor, materials, equipment and transportation required to complete Earthwork as indicated on the drawings, as designated by the Engineer, or as specified herein, to complete all proposed work.

A. The Contractor or Sub-contractor must have a minimum of five (5) years of experience installing walls, walkways and pavements, foundations, athletic fields, and trails of similar size and quality as this project.

C. Without limiting the generality thereof, Earthwork shall include excavating, furnishing borrow materials as necessary, and backfilling for the construction of all proposed work from existing grades to finished grades. Work shall include the removal of unclassified material, such as bituminous pavements, curbs, ledge and boulders under one (1) cubic yard in size, concrete, reinforced and plain, structures, and metal or wood posts; and unsuitable materials of every nature throughout the site within twelve (12) inches below finished subgrade elevations for proposed work or as indicated or required for new construction; transportation of the excavated materials; backfilling to proposed base course subgrades with approved excavated and/or furnished materials; and the legal disposal of unsuitable, and/or surplus excavated materials.

D. Work under this Section shall also include the skimming and removal of existing grass or topsoil areas to remove all sod clumps and vegetation and the complete excavation, stockpiling, rehandling, spreading, and re-use (placing) of on-site topsoil in conformity with the lines, grades and dimensions shown on the plans. This material <u>may</u> be utilized where <u>general embankment</u> (not beneath pavements, fields or structural improvements) is proposed at the sole discretion of the Owner. The Contractor shall take extreme care in the process of stripping and stockpiling existing topsoil to insure that subsoil to remain in place is not mixed with the topsoil. Compacted areas subject to construction traffic shall be disced to the full depth of topsoil without mixing in subsoil.

E. Work under this Section shall include the furnishing of all borrow materials required to complete the proposed work as designed. Where "processed gravel", "gravel borrow", or "gravel" is indicated in the specifications or on the drawings, only gravel conforming to this section of the specifications may be utilized.

F. All topsoil/loam for seeding, whether re-used or furnished from off-site, shall conform to Section 02910 of these Specifications.

G. The Contractor shall make excavations of normal depth in earth for trenches and structures, shall backfill and compact such excavations to the extent necessary, shall

furnish the necessary material and construct embankments and fills, and shall make miscellaneous earth excavations and do miscellaneous grading.

1.02 RELATED WORK:

A. Special Conditions, PERMITS

B Section 01570, ENVIRONMENTAL PROTECTION

C. Section 02910, SCREENED LOAM BORROW AND TOPSOIL RE-USED

D. Section 02920, SODDING

1.03 REFERENCES:

AASHTO - American Association of State Highway and Transportation Officials (tests or specifications). AASHTO or AASHO

AWWA - American Waterworks Association

American Society for Testing and Materials (ASTM)

ASTM	C 131	Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM	C136	Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM	C330	Specification for Lightweight Aggregate for Structural Concrete.
ASTM	Dl 556	Test Method for Density of Soil in Place by the Sand Cone Method.
ASTM	D1557	Test Methods for Moisture-density Relations of Soils and Soil Aggregate Mixtures Using Ten-pound (10 Lb.) Hammer and Eighteen-inch (18") Drop.
ASTM	D2922	Test Methods for Density of Soil and Soil-aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM	F-2396 – 04	Standard Guide for Construction of High Performance Sand-Based Rootzones for Sports Fields

Commonwealth of Massachusetts Highway Department Standard Specification for Highways and Bridges.

Code of Massachusetts Regulations (CMR) 310.40.0032 Contaminated Media and Contaminated Debris

Code of Massachusetts Regulations (CMR) 520 CMR 1400 Excavation & Trench Safety Regulations.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Samples of all materials proposed for the project shall be submitted to the Engineer for review. Size of the samples shall be as approved by the Engineer.

1.05 PROTECTION OF EXISTING PROPERTY:

A. The work shall be executed in such manner as to prevent any damage to facilities at the site and adjacent property and existing improvements, such as but not limited to parking areas, curbs, paving, service utility lines, structures, monuments, bench marks, observation wells, and other public or private property. Protect existing improvements from damage caused by settlement, lateral movements, undermining, washout and other hazards created by earthwork operations.

B. In case of any damage or injury caused in the performance of the work, the Contractor shall, at its own expense, make good such damage or injury to the satisfaction of, and without cost to, the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to at least the condition that existed at the start of operations. The Contractor shall replace, at his own cost, existing benchmarks, observation wells, monuments, and other reference points, which are disturbed or destroyed.

C. Buried drainage structures and pipes, observation wells and piezometers, including those which project less than eighteen inches (18") above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard. Markers shall indicate limits of danger areas, by means which will be clearly visible to operators of trucks and other construction equipment, and shall be maintained at all times until completion of project.

1.06 DRAINAGE:

A. The Contractor shall provide, at its own expense, adequate drainage facilities to complete all work items in an acceptable manner. Drainage shall be done in a manner so that runoff will not adversely affect construction procedures or cause excessive disturbance of underlying natural ground or abutting properties. All work shall be done in the dry.

1.07 FROST PROTECTION AND SNOW REMOVAL:

A. The Contractor shall, at its own expense, keep earthwork operations clear and free of accumulations of snow as required to carry out the work.

B. The Contractor shall protect the subgrade beneath new structures and pipes from frost penetration when freezing temperatures are expected.

1.08 SPECIAL REQUIREMENTS:

A. The sequence of all excavation operations shall be such as to insure the most efficient re-use of suitable excavated materials and the use of a minimum amount of specified borrow.

B. The Contractor shall inform and satisfy himself as to the character, quantity, and distribution of all material to be excavated. No payment will be made for the placement of any excavated material which is used for purposes other than those designated and as specified herein. Further, these shall be removed at no cost to the Owner if so directed by

the Engineer.

C. The Engineer shall have final determination over the excavation, moving, placing and disposition of all materials, and shall determine the suitability of materials to be placed in excavated areas.

D. All backfill to subgrade, shall be compacted to not less than ninety-five percent (95%) of the maximum dry density of the material as determined by the Standard AASHTO Test Designation T-180-86, Modified Proctor Test with the exception of the athletic field areas which shall be compacter per Section 02911.

E. Unsuitable and/or excess excavated materials shall be removed and properly disposed of in legal disposal areas off of the site at no additional cost to the Owner.

F. Exploratory excavation to locate existing utilities or obstructions, shall be at the Contractor's discretion to assist him in the work of this project and no extra payment shall be made for such verification. Although extra payment is not considered, lack of such payment does not constitute a waiver of the Contractor's responsibility to verify all utilities. The contractor must ensure verification of existing services and ensure the safety of the Contractor's work forces.

PART 2 – PRODUCTS

2.01 BORROW MATERIALS:

A. Excavated topsoil and furnished topsoil to be utilized for sodding, seeding and landscaping must conform to Section 02910 SCREENED LOAM BORROW AND TOPSOIL RE-USED in order to be used as Loam Borrow. Existing topsoil not passing tests for Loam Borrow may be considered suitable as general fill below subgrade, in landscaped areas only and may be utilized throughout the proposed sod and seeded areas, up to subgrades of proposed work.

B. Gravel Borrow shall be as specified under paragraph 2.03 of these Specifications and shall be utilized whenever gravel is noted, including beneath pavements and structural elements unless otherwise noted.

C. Although suitable excavated backfill materials and topsoil may be reused to fill to subgrade as specified herein, if there are insufficient quantities of materials available the Contractor shall furnish Suitable Backfill as specified in paragraph 2.02A below.

D. If approved by the Engineer, Suitable Backfill materials excavated from beneath pavements may be utilized as backfill from four inches above the overt of pipes so long as all material over four (4) inches in size is removed from the material prior to backfilling and all trench compaction requirements may be met.

E. Where Sand Borrow is required, materials shall conform to Section M1.04.1 of the Massachusetts Standard Specifications. Utilize Sand Borrow as necessary for regarding subgrade.

2.02 SUITABLE ON SITE BACKFILL

A. All other materials to be placed where Specifications or Drawings call for "fill," "backfilling," or "filling" to subgrade, shall be natural soil, well-graded and free from all organic weak, compressible, and frozen materials, and shall contain no stone larger than four (4) inches in maximum dimension. It shall be of such nature and character that it can be dried and compacted and shall be free of all expansive materials (such as high plastic clays) and of materials subject to decay, decomposition, or dissolution, and shall conform to the following gradations:

U.S. Sieve No.	Total Percent Passing by Weight
4 inch	100
#4	20-75
#40	0-25
#200	0-5

B. If, sufficient suitable fill material is not available from excavations under this Contract, to complete filling to subgrades as specified above, additional fill, as specified under paragraph 2.02A above, shall be furnished by the Contractor from other sources at no additional cost. Excavated material from the site, and furnished material for use as Suitable Backfill, shall be deemed suitable only if they meet the requirements of paragraph 2.02A above, can be properly compacted, and are satisfactory to the Engineer.

C. Use Suitable Backfill compacted as specified for general grading as backfill except as specified herein; fill to sub-grades of proposed work where shown.

2.03 MATERIALS:

A. GRAVEL BORROW:

Gravel Borrow shall satisfy the requirements listed in MASSDOT Specification Section M1.03.0, Type b.

B. CRUSHED STONE:

Crushed stone shall satisfy the requirements listed in MASSDOT Specification Section M2.01.

C. SAND BORROW:

Sand Borrow shall satisfy the requirements listed in MASSDOT Specification Section M1.04.0.

D. PEASTONE:

Peastone shall be smooth, hard, naturally occurring, rounded stone meeting the following gradation requirements:

Passing 5/8 inch square sieve opening	100%
Passing No. 8 sieve opening	0%

E. BACKFILL MATERIALS:

1. Class B Backfill:

Class B backfill shall be granular, well graded friable soil; free of rubbish, ice, snow, tree stumps, roots, clay and organic matter; with 30 percent or less passing the No. 200 sieve; no stone greater than two-third (2/3) loose lift thickness, or six inches, whichever is smaller.

2. Select Backfill:

Select backfill shall be granular, well graded friable soil, free of rubbish, ice, snow, tree stumps, roots, clay and organic matter, and other deleterious or organic material; graded within the following limits:

Sieve Size	Percent Finer by Weight
3"	100
No. 10	30-95
No. 40	10-70
No. 200	0-10

F. LOAM BORROW:

Loam Borrow shall satisfy the specification section 02910 included in these specifications.

G. PROCESSED GRAVEL:

1. Processed gravel shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials. The coarse aggregate shall have a percentage of wear, by the Los Angeles Abrasion Test, of not more than 50.

2. The gradation shall meet the following requirements:

Sieve Designation	Percentage Passing
3 in.	100
1 1/2 in.	70-100

1/4 in.	50-85
No. 4	30-60
No. 200	0-10

3. The approved source of bank-run gravel material shall be processed by mechanical means. The equipment for producing crushed gravel shall be of adequate size with sufficient adjustments to produce the desired materials. The processed material shall be stockpiled in such a manner to minimize segregation of particle sizes. All processed gravel shall come from approved stockpiles.

PART 3 - EXECUTION

3.01 DISTURBANCE OF EXCAVATED AND FILLED AREAS DURING CONSTRUCTION:

A. Contractor shall take the necessary steps to avoid disturbance of subgrade during excavation and filling operations, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering and other acceptable control measures.

B. Contractor shall not disturb sand filter layer that is located below the topsoil layer.

3.02 EXCAVATION:

A. GENERAL:

1. The Contractor shall perform all work of any nature and description required to accomplish the work as shown on the Drawings and as specified.

2. Excavations, unless otherwise required by the Engineer, shall be carried only to the depths and limits shown on the Drawings. If unauthorized excavation is carried out there could be damage to the landfill cap. Contractor will be required to repair at no additional cost to the owner.

3. In all excavation areas, the Contractor shall strip the surficial topsoil layer and underlying subsoil layer separate from underlying soils.

4. The Contractor shall follow a construction procedure, which permits visual identification of stable natural ground. Where groundwater is encountered, the size of the open excavation shall be limited to that which can be handled by the Contractor's chosen method of dewatering and which will allow visual observation of the bottom and backfill in the dry.

5. The Contractor shall excavate unsuitable materials to stable natural ground where encountered at proposed excavation subgrade, as directed by the Engineer. Unsuitable material includes topsoil, loam, peat, other organic materials, snow, ice,

and trash. Unless specified elsewhere or otherwise directed by the Engineer, areas where unsuitable materials have been excavated to stable ground shall be backfilled with compacted special bedding materials or crushed stone wrapped all around in non-woven filter fabric.

6. When the plans require excavation in areas in proximity to existing sidewalks, structures and utilities, it shall be the responsibility of the Contractor, at his own expense, to provide adequate and suitable drainage away from proposed work and existing features or use other satisfactory means and methods to protect and maintain the stability of such construction within or adjacent to the limits of work.

7. Protect all existing trees, shrubs or other plan referenced features to remain. Hand excavate around all items to remain including tree roots or where utilities must be verified. Exposed tree roots shall be immediately covered with Loam Borrow in accordance with these specifications.

8. No roots greater than two (2) inches in diameter shall be cut from trees to remain without approval of the Engineer. Roots greater than one (1) inch in diameter that are cut or broken shall be promptly pruned to a smooth clean cut and painted with an approved compound.

9. Any removal of existing facilities required in order to achieve the excavation to proceed, such as fences, walls, walkways, etc., shall be accomplished by the Contractor at no additional cost to the owner. Restoration of these facilities shall be to a condition equal to that before removal, and safe and operational to the satisfaction of the Engineer.

10. Excavation shall be performed to the lines, grades, and elevations shown on the plans or as directed by the Engineer, and shall be made in such a manner that the requirements for formation of the subgrade can be followed.

11. No excavation shall be started until the Engineer has reviewed and acknowledged the area of proposed construction. All material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times.

12. The planes at the bottom of the excavation (in cut), or the top of the fill, when completed, shall be known as the subgrade, and shall be true to the lines, grades and cross section shown on the plans, to allow proposed work (base courses and finished courses) to be completed.

13. All unsuitable excavated material shall be legally disposed of outside of, and away from, the project limits. All suitable excavated material deemed surplus by the Engineer shall become the property of the Contractor and shall be properly removed from the site.

14. Fills to subgrade level shall be formed of successive layers not exceeding six (6)

inches in depth and each layer shall be compacted to not less than 95 percent of maximum dry density of the material as determined by the standard AASHTO Test Designation T-180-86, Modified Proctor Test.

15. No additional payment will be made for materials removed, manipulated or replaced by the Contractor in order to obtain the specified density. Any removal, manipulation, aerating, replacement and re-compaction of materials necessary to obtain the required density shall be considered as incidental to the excavation and compaction operations and shall be performed by the Contractor at no additional cost.

16. After the areas to receive loam borrow have been brought to subgrade, and immediately prior to placing and spreading such material, the subgrade shall be loosened by discing to a depth of at least three inches to permit bonding of the finished material to the subgrade material. Then place and spread the loam borrow to the depths required by the Drawings to establish finish grades. Refer to Loam Borrow Specifications.

17. Protect all existing areas against damage due to the work under this Contract, and perform all repair and replacement work to any such areas which are damaged hereunder.

18. No extra work shall be initiated without notification of the Engineer in writing, and the written approval of the Engineer in response.

19. The Contractor shall be responsible for any and all pumping or bailing necessary to complete his operations, and to keep all areas sufficiently dry to guarantee compaction in accordance with the specifications.

20. Where insufficient suitable materials of any kind exist on site for incorporation into the proposed work within proposed work lines, the Contractor shall furnish materials from off site, as necessary and in accordance with these specifications, at no additional cost to the Owner.

C. EXCAVATION NEAR EXISTING STRUCTURES:

1. Attention is directed to the fact that there are pipes, manholes, drains, and other utilities in certain locations. An attempt has been made to locate all utilities on the drawings, but the completeness or accuracy of the given information is not guaranteed. The contractor is responsible for contacting dig safe and appropriate municipal departments prior to construction operations begin to indicate general location of all utilities.

2. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and excavation shall be done by means of hand tools, as required. Such manual excavation, when incidental to normal excavation, shall be included in the work to be done under items involving normal excavation.

3. Where determination of the exact location of a pipe or other underground structure is necessary for properly performing the work, the Contractor shall excavate test pits to determine the locations.

D. TRENCH HAND EXCAVATION

a. When approaching the vicinity of significant tree roots, underground pipes, conduits, or other structures, or any suspected functioning underground features, digging by machinery shall be discontinued and the excavation shall be done by hand. Hand excavation shall also be undertaken when so directed by the Engineer. Such hand excavation shall be considered incidental to the trench excavation and no additional compensation will be allowed.

b. Protection of Existing Structures - All existing pipes, conduits, poles, wires, fences, curbing, property line markers, and other structures which, in the opinion of the Engineer, are not required to be changed in location, shall be carefully supported and protected from injury by the Contractor, and in case of damage, they shall be restored by the Contractor without additional compensation, to as good a condition as that in which they were found.

3.03 BACKFILL PLACEMENT AND COMPACTION:

A. GENERAL:

1. Prior to backfilling, the Contractor shall compact the exposed natural subgrade to the densities as specified herein.

2. After approval of subgrade by the Engineer, the Contractor shall backfill areas to required contours and elevations with specified materials.

3. The Contractor shall place and compact materials to the specified density in continuous horizontal layers. The degree of compaction shall be based on maximum dry density as determined by ASTM Test D1557, Method C. The minimum degree of compaction for fill placed shall be as follows:

Location	Percent of Maximum Density
Below pipe centerline	95
Above pipe centerline	92
Below pavement (upper 3 ft.)	95
Embankments	95
Below pipe in embankments	95
Adjacent to structures	92
Below structures	95

4. The Engineer reserves the right to test backfill for conformance to the specifications and Contractor shall assist as required to obtain the information. Compaction testing

will be performed by the Engineer or by an inspection laboratory designated by the Engineer, engaged and paid for by the Owner. If test results indicate work does not conform to specification requirements, the Contractor shall remove or correct the defective Work by recompacting where appropriate or replacing as necessary and approved by the Engineer, to bring the work into compliance, at no additional cost to the Owner. All backfilled materials under structures and buildings shall be field tested for compliance with the requirements of this specification.

5. The Contractor shall remove loam and topsoil, loose vegetation, stumps, large roots, etc., from areas upon which embankments will be built or areas where material will be placed for grading. The subgrade shall be shaped as indicated on the Drawings and shall be prepared by forking, furrowing, or plowing so that the first layer of the fill material placed on the subgrade will be well bonded to the subgrade.

3.04 DISPOSAL OF SURPLUS MATERIALS:

A. Surplus excavated materials, which are acceptable to the Engineer, shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill. Upon written approval of the Engineer, surplus excavated materials shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes as indicated by the Owner, within its jurisdictional limits; all at no additional cost to the Owner.

B. Surplus excavated material not needed as specified above shall be hauled away and disposed of by the Contractor at no additional cost to the Owner, at appropriate locations, and in accordance with arrangements made by him. Disposal of all rubble shall be in accordance with all applicable local, state and federal regulations.

C. No excavated material shall be removed from the site of the work or disposed of by the Contractor unless approved by the Engineer.

D. The Contractor shall comply with Massachusetts regulations (310 CMR 40.0032) that govern the removal and disposal of surplus excavated materials. Materials, including contaminated soils, having concentrations of oil or hazardous materials less than an otherwise Reportable Concentration and that are not a hazardous waste, may not be disposed of at locations where concentrations of oil and/or hazardous material at the receiving site are significantly lower than the levels of those oil and /or hazardous materials present in the soil being disposed or reused.

E. Soil testing, if required, for all materials to be reused on-site or removed and disposed of offsite, shall be the responsibility of the contractor. The town reserves the right to obtain its own test results from the same sample as the contractor without penalties to the owner. The contractor is required to obtain a large enough sample to divide with the owner for this proposes.

END OF SECTION

SECTION 02515

SERVICE CONNECTIONS (WATER SERVICES)

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section covers the furnishing and installation of new water service connections and the repair, replacement, and/or transfer of existing water service connections as shown on the drawings, as specified herein, and as required by the Engineer.

1.02 RELATED WORK:

A. Section 02080, DUCTILE IRON PIPE AND FITTINGS

B. Section 02755, BITUMINOUS CONCRETE PAVING

C. Section 02290, SEEDING

1.03 REFERENCES:

A. The following standards form a part of this specification:

American Society for Testing and Materials (ASTM)

ASTM	B88	Seamless Copper Water Tube
ASTM	B584	Copper Alloy Sand Castings for General Applications
ASTM	D2737	Polyethylene (PE) Plastic Tubing

American Water Works Association (AWWA)

AWWA	C800	Water-Service Line Fittings
AWWA	C651	Disinfecting Water Mains
AWWA	C901	Polyethylene Pressure Pipe & Tubing, 1/2-inch through 3-inch for Water Service

Federal Specifications (FS)

FS	WW-T-799C	Tube, Copper, Seamless

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF THE GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Six sets of manufacturer's literature of the materials of this section for review.

PART 2 - PRODUCTS

2.01 SERVICE PIPING:

A. Piping between the existing water main and the curb stop shall be buried continuous Type K annealed seamless copper water tubing conforming to ASTM B88 Standard Specification for Seamless Copper Water Tube or U.S. Federal Specification WW-T-799C for Tube, Copper, Seamless. Tubing shall be 1-inch diameter unless otherwise indicated.

B. Piping between the curb stop and the restroom facility shall be buried polyethylene (PE 4710) water services shall conform to ASTM D2737 and be as specified in AWWA C901. Polyethylene piping shall be designed for 200 psi minimum service and tested at 330 psi for 1,000 hours or greater. The tubing shall be copper O.D. size and be suitable for use with standard industry brass compression fittings without special adapters. Stainless steel insert stiffeners shall be provided for use with all compression joint connections.

C. Couplings, if required, for existing to new service pipe connections shall have compression connections on the inlet and compression connections on the outlet. Couplings shall be made of brass as specified in AWWA C800. All brass components that come into contact with potable water shall be made from either CDA/UNS Brass Alloys C89520 or C89833 and shall not contain more than twenty five hundredths of one percent (0.25% or less) total lead content by weight. The lead leach limit of the coupling shall be 5 parts per billion (ppb). Couplings shall be NSF/ANSI 61 Annex F and Annex G and NSF/ANSI 372 certified by an ANSI accredited organization and shall be stamped or embossed with a mark or name indicating that the product is manufactured from a low-lead alloy, as specified above.

2.02 CORPORATION STOPS:

A. Corporations stops shall be made of brass as specified in AWWA C800. All brass components that come into contact with potable water shall be made from either CDA/UNS Brass Alloys C89520 or C89833 and shall not contain more than twenty five hundredths of one percent (0.25% or less) total lead content by weight. The lead leach limit of the corporation stops shall be 5 ppb. Corporation stops shall be NSF/ANSI 61 Annex F and Annex G and NSF/ANSI 372 certified by an ANSI accredited organization and shall be stamped or embossed with a mark or name indicating that the product is manufactured from a low-lead alloy, as specified above.

B. Corporation stops shall be approved for use with copper and plastic water service pipe. The inlet shall have AWWA taper thread (CC) connections and the outlet shall have compression connections.

C. Service clamps shall be installed with all corporation stops 2-inches and larger in size and with all corporation stops installed in PVC pipe. Clamps shall be all bronze, ductile iron or stainless steel, double strap, AWWA taper thread (CC) with O-ring seal.

D. Corporation stops shall be by Ford Meter Box Co., Inc., Wabash, IN; Red Hed Manufacturing Co., Lincoln, RI; Mueller Co., Decatur, IL; or approved equal.

2.03 CURB STOPS:

A. Curb stops shall be of brass as specified in AWWA C800. All brass components that come into contact with potable water shall be made from either CDA/UNS Brass Alloys C89520 or C89833 and shall not contain more than twenty five hundredths of one percent (0.25% or less) total lead content by weight. The lead leach limit of the curb stops shall be 5 ppb. Curb stops shall be NSF/ANSI 61 Annex F and Annex G and NSF/ANSI 372 certified by an ANSI accredited organization and shall be stamped or embossed with a mark or name indicating that the product is manufactured from a low-lead alloy, as specified above.

B. Curb stops shall be inverted key style and the inlet and the outlet shall have compression connections.

C. Curb stops shall be by Red Hed Manufacturing Co., Lincoln, RI; Ford Meter Box Co., Inc., Wabash, IN; Mueller Co., Decatur, IL; or approved equal.

2.04 CURB BOXES:

A. The cast iron box shall be the sliding Buffalo type with Minneapolis pattern base. Minimum inside diameter of the upper section shall be 1-1/2-inch for 3/4-inch and 1-inch curb stops and 2-inch for 1-1/2-inch and 2-inch curb stops. Curb box lid shall shall be Erie pattern.

B. Boxes shall be equipped with 30-inch stationary extension rods with pinned connections to the curb stop.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Where new water mains are being installed and existing water services are to be transferred to the new main, the Contractor shall discontinue the existing water services by shutting down the corporation stop at the old water main, unless specifically otherwise required by the Engineer. The Contractor shall take special care to minimize the interruption of existing water service.

B. The Contractor shall tap a new corporation stop, cut the existing service piping and connect the new service piping to the old service piping using an approved coupling at a point between the main and the existing curb stop and box.

C. Where transfers are to be made and the existing curb stop and box cannot be utilized or a new curb stop and box is required, the Contractor shall connect the new service piping to the existing service piping using an approved coupling approximately 12-inches from the curb stop on the building side of the stop.

D. Where transfers are being made and the existing service is of lead, galvanized steel, or iron, the service shall be replaced to the curb stop and box unless otherwise required. If required, the curb stop and box shall be replaced as specified above.

E. Curb stops and boxes shall be set plumb, flush with the ground or paved surface, and centered with the box located directly over the stop. The box shall be set on a concrete block or flat stone. Earth fill shall be carefully tamped around the boxes to a distance of 4 feet on all sides of the box or to the undisturbed face of the trench, if less than 4 feet.

F. Curb stops shall be operational and accessible at all times during construction and warranty period. The Contractor shall verify the proper operation of all curb stops in the presence of the Engineer and/or Owner following completion of the project and prior to the acceptance of substantial completion.

G. All services shall be installed at 5 feet 0 inches of cover unless otherwise required by the Engineer.

H. Service connections shall be tested and disinfected in accordance with AWWA standards.

END OF SECTION

SECTION 02516

CONNECTIONS TO EXISTING WATER MAINS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This section covers connections to existing water mains, complete.

B. The Contractor shall furnish all pipe, fittings, valves, tapping machines, if required, and appurtenances. The Contractor shall do all excavation and backfill as required.

1.02 RELATED WORK:

A. Section 02080, DUCTILE IRON PIPE AND FITTINGS.

B. Section 02511, TEMPORARY WATER SERVICE.

C. Section 02514, HYDRANTS AND VALVES. (Tapping sleeves and valves specified)

D. Section 03302, FIELD CONCRETE.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION

3.01 CONTRACTOR OPERATIONS:

A. The Contractor shall make all connections to the existing mains as indicated on the drawings and as herein specified.

B. The Contractor shall develop a program for the construction and putting into service of the new work subject to the approval of the Engineer. All work involving cutting into and connecting to the existing work shall be planned so as to interfere with operation of the existing facilities for the shortest possible time and when the demands on the system best permit such interference even to the extent of working outside of normal working hours to meet these requirements.

C. The Contractor shall have all possible preparatory work done prior to making the connection and shall provide all labor, tools, material, and equipment required to do the work in one continuous operation.

D. The Contractor shall have no claim for additional compensation, by reason of delay or inconvenience, for adapting his operations to the needs of the Owner's water supply. No damages shall be claimed by the Contractor for delays in dewatering pipelines nor shall any damages be claimed because of water leaking through closed valves after dewatering is completed.

E. Under no circumstances shall any customers be without water for a period of more than 4 hours without prior approval of the Owner. Should it appear that any customer will be without water for more than 4 hours, the Contractor shall install temporary water service as specified in Section 02511, TEMPORARY WATER SERVICE where required by the Engineer.

F. Existing pipeline that is not to be abandoned but is damaged by the Contractor during the work shall be replaced by him at his own expense in a manner approved by the Engineer.

3.02 TAPPING CONNECTION TO EXISTING MAINS:

A. Tapping connections to the existing mains, where indicated on the drawings, shall be made with service pressure in the main, using tapping sleeves and valves and a suitable tapping machine.

B. Other connections to existing mains shall be made with the main out of service, unless otherwise required by the Engineer. Such connections will not require tapping sleeves and valves but connections as indicated on the drawings.

END OF SECTION

SECTION 02533

CONNECTIONS TO EXISTING STRUCTURES

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall furnish materials, tools, labor and equipment to cut suitable openings into existing manholes or box culverts, make connections to existing and all other work necessary to direct the existing flow as indicated on the drawings and as herein specified.

1.02 RELATED WORK:

A. Section 02630, DRAINAGE STRUCTURES

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF THE GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Prior to start of work, submit details of the methods proposed for doing the work and for maintaining the existing flow as herein specified.

PART 2 – PRODUCTS

A. Connections to existing box culverts shall be accomplished using a watertight flexible connector such as the Kor-N-Seal 106-406 series connector or approved equal. The connector shall be compatible with the type of pipe being used at the point of connection.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. The Contractor shall provide temporary plugs or provide other suitable means for maintaining the new free of flow until such time as it can be inspected and tested for leakage.

B. Connections to the new or existing structure shall be made when required by the Engineer and only after the new pipeline has been inspected and has successfully passed the leakage test.

C. The Contractor shall modify each existing structure for installation of the necessary piping, but in so doing shall confine the cutting to the smallest amount possible consistent with the work to be done.

D. All new piping connected to existing structures shall be encased in concrete in a manner satisfactory to the Engineer.

E. All work shall be done with the proper tools and by careful workmen competent to do work.

F. For connections to manholes, the Contractor shall cut, reshape and fill existing manhole tables and plug existing outlets as indicated on the drawings and as directed by the Engineer, to accommodate the new connections. Reshaped manhole invert channels shall be smoothly shaped to permit the flow of sewage. Manhole invert channels shall be reconstructed as specified under Section 02631, DRAINAGE STRUCTURES.

G. For connections to existing box culverts, the Contractor shall core drill an opening of sufficient size as recommended by the manufacturer to install an approved flexible connector to seal the connection between the proposed drain pipe and the culvert wall.

END OF SECTION

SECTION 02625

DRAINAGE PIPE

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Under this Section the Contractor shall furnish all materials, equipment, labor, transportation, facilities and all operations and adjustments required for the installation of drainage and subdrain pipe and all incidentals thereto.

B. Drainage and subdrainage pipe shall be placed in the sizes and lengths indicated on the plans.

C. Provide all coordination and pay all fees associated with installation of the sewer connection.

D. Pipe shall be solid wall or perforated as indicated on the drawings and details.

1.02 SHOP DRAWINGS/MANUFACTURER'S CUTS AND SPECIFICATIONS:

A. The Contractor shall submit to the Engineer for approval all materials and equipment proposed for use indicating manufacturers' names and addresses, identifying data and expected delivery dates. No consideration will be given to partial lists submitted from time to time. Intention of using specified materials and equipment shall not relieve the Contractor from submitting the above list, nor shall submission of the list relieve him from submission of shop drawings. Any item of material or of equipment not submitted for approval on the list will not be approved unless of the exact make and characteristics specified. Refer to Submittal Section of these Specifications.

B. If the material or equipment is installed before it is approved, the Contractor shall be liable for the removal and replacement at no extra charge to the Owner, if, in the opinion of the Engineer, the material or equipment does not meet the intent of the Contract Documents.

C. The Contractor shall submit the following information with all equipment shop drawings:

1. Manufacturer's certified scale drawings, cuts or catalogs, including installation details.

2. Manufacturer's specifications, including certified performance characteristics and capacity ratings.

1.03 SAMPLES:

A. The Contractor shall submit all samples as requested in accordance with the provisions of the GENERAL CONDITIONS. Samples accepted will be returned to the Contractor within five (5) days and may be incorporated into the work. Samples not accepted will be returned for disposition by the Contractor.

1.04 CODES, ORDINANCES AND PERMITS:

A. All work shall be performed in strict accordance with local and state codes and regulations.

1. Site utilities work shall be done in strict accordance with the Commonwealth of Massachusetts State Plumbing Code, latest edition, and all revisions thereto.

2. Any material or workmanship called for in the above-mentioned requirements, which are not specified or shown on the drawings, shall be furnished and installed by the Contractor as though same has been specifically mentioned or indicated. If the drawings and specifications are at variance with any regulations, the bidder shall notify the Landscape Architect ten (10) days before the date for submitting his bid. In many cases the drawings are in excess of the requirements in the codes and these shall be followed to the fullest. If the Contractor fails to notify the Engineer at this time and installs work in variance with the above-mentioned codes and regulations, he shall assume the responsibility and the expense to rectify the installation.

3. Before commencing work, the Contractor shall obtain all permits necessary in connection with the installation of this equipment and pay fees required for same. He shall include the cost and backcharge of installing any portion of the work where performed by municipal departments or utility companies. City reserves the right for inspection and approval of all work.

1.05 SUBSTITUTIONS:

A. Any reference to a particular device, product, material, article or system shall be interpreted as establishing a standard of quality, design, performance, or function, and shall not be construed as limiting competition.

1.06 RECORD DRAWINGS:

A. The Contractor shall submit record drawings as specified in the GENERAL CONDITIONS.

1.07 SITE VISITATION:

A. It is recommended that all prospective bidders visit the job site to acquaint themselves with the general and special conditions that may be encountered which will have a bearing on labor, transportation, cutting and patching, material handling and storage, and similar items, during the prosecution of the work. Failure to do so shall not relieve him of his responsibility for properly estimating the difficulties involved in the work to be performed under this section.

1.08 REFERENCE STANDARDS:

A. References herein to any technical society, organization, group or body is made in accordance with the following abbreviations.

ASTM American Society for Testing Materials

AWWA American Water Works Association

Massachusetts DOT Standard Specifications.

1.09 MATERIALS AND WORKMANSHIP:

A. It is the intent of these specifications to establish quality standards for all material and equipment incorporated in the work of this section. All material and equipment installed hereunder shall be new and shall be the best of each respective kind and type. Proper care shall be exercised in handling all equipment and materials herein specified.

B. The installation shall be as indicated on the drawings and in accordance with the manufacturer's recommendations as approved by the Engineer. The installation shall be accomplished by workmen skilled in this type of work.

C. All conduits, pipes, structures, etc. in use and which are damaged during excavation, whether uncovered or not and whether or not they are shown on the plans, shall be repaired at the expense of the Contractor.

E. Storage of materials by the Contractor for incorporation into the work shall be off the site for other than material that is scheduled to be installed in the time span of two (2) working days. The storage site selected by the Contractor shall be made accessible to the City inspection forces at all times during normal working hours.

PART II-MATERIALS

2.01 GENERAL:

A. Drawings and specifications are intended to supplement and explain each other. Materials not specifically mentioned in the specifications shall be as indicated on the drawings. Where conflicts occur between the drawings and/or specifications or within either document itself, the item or arrangement of better quality, greater quantity or higher cost shall be included in the Contractor's bid. Where no specific kind of quality of material is given, a first-class standard article shall be furnished.

2.02 CORRUGATED POLYETHLYLENE DRAINAGE PIPE (HDPE):

A. Pipe and fittings shall be made of virgin PE compounds which conform with the requirements of Type III, Category "4" or "5", Grade P 33, Class C, or Grade P 34, Class C as defined and described in ASTM 1248.

B. Clean reworked material generated from the manufacturer's own production may be used by the manufacturer provided that the tubing or fittings produced meet all requirements of this specification.

C. When perforated tubing is specified, the perforations shall be cleanly cut so as not to restrict the inflow of water, and uniformly spaced along the length and circumference of the tubing. Circular perforations shall not exceed 3/16 in. in diameter. Width of slots shall not exceed 1/8 in. The length of individual slots shall not exceed 1-1/4 in. on 3 in. diameter tubing, 10 percent of the tubing inside nominal circumference on 4 to 8 in. diameter tubing, and 2-1/2 in. on 10 in. diameter tubing. Slots shall be centered in the valleys of the corrugations. The water inlet area shall be a minimum of 1 square inch per linear foot of tubing.

D. Only fitting supplied or recommended by the tubing manufacturer should be used.

E. Fittings shall not reduce the inside diameter of the tubing being joined by more than 5 percent of the nominal inside diameter. Reducer fittings shall not reduce the cross-sectional area of the smaller size.

F. Visible Defects: Cracks, creases, un-pigmented or non-uniformly or non-uniformly pigmented pipe are not permissible.

G. All pipe and fittings shall be clearly marked at intervals of no more than 10 feet with the following:

1. Manufacturer's name or trademark.
2. Nominal size
3. This specification designation, "M294"
4. The plant designation code.

5. The date of manufacture or an appropriate code.

H. Pipe bedding and backfill shall be installed in a manor protection the integrity of the pipe. Improper preparation could result in the crushing of the pipe even with no other additional weight applied to the finish grade.

I. Furnish pipe in the sizes indicated on the plans and/or details.

2.03 CRUSHED STONE

A. Refer to Specification EARTHWORK Section of these specifications.

2.04 APPURTENANCES

A. Provide all appurtenance and incidentals necessary to make the drainage pipe installation and connection complete and acceptable, including all materials necessary for the excavation, backfill, compaction and restoration of lawn areas pavements, sidewalks and curblines.

PART III - EXECUTION

3.01 PIPE INSTALLATION :

A. Prior to excavating trenches the Contractor shall field verify all existing inverts and inform the Engineer of any discrepancies. Record these inverts on Record Drawings.

B. The trench for the pipe shall be excavated to the required line and grade and be of sufficient width to permit thorough tamping of the fill material under the haunches and around the pipe. Soft or unsuitable material encountered below the normal bedding line of the pipe shall be removed as directed, replaced with gravel and thoroughly compacted. The bottom of the trench shall be shaped to conform to the curvature of the pipe. This bed shall also be excavated to accommodate the bells of pipes.

C. The pipe shall be laid true to the specified lines and grades where shown on the Plans and as directed. The bell end shall be toward rising grade and each section of pipe shall have a firm bearing throughout its length. Material placed around and under the pipe shall be free of stones larger than three (3) inches in diameter.

D. No load greater than three (3) tons shall be moved over any pipe until a fully-compacted backfill of at least two (2) feet has been placed over the top of the pipe. This minimum will be increased to three and one-half (3-1/2) feet for a forty thousand (40,000) pound single wheel load and to four (4) feet for a sixty thousand (60,000) pound single wheel load. The required fully-compacted backfill cover shall be placed a minimum of fifty (50) feet on both sides of the pipe crossing. However, compliance with this requirement is not to be construed

as relieving the Contractor of any responsibility concerning damage to the pipe.

E. Backfill for pipes shall conform to Section 02300 of these Specifications and shall be placed between the pipe and the walls of the trench in layers not exceeding six (6) inches in depth and thoroughly compacted. Each layer, if dry, shall be moistened and then compacted by rolling or by tamping with mechanical rammers. Compaction with iron hand tampers having a tamping face not exceeding twenty-five (25) square inches in area may be allowed only after permission has been given by the Engineer. Special care shall be taken to thoroughly compact the fill under the haunches of the pipe. This method of filling and compacting shall be continued until the material is level with the top of the pipe. The remainder of the filling shall consist of suitable material placed in successive layers not more than six (6) inches in depth. Each layer shall be thoroughly compacted in accordance with AASHTO-T99 Standard Proctor Test.

F. Any pipe showing settlement after laying or which is not in true alignment or is otherwise unsatisfactory before final acceptance of the work shall be taken up and replaced or relayed by the Contractor without additional compensation.

3.02 WATER REMOVAL:

A. If water is encountered during construction, provisions must be made to remove the water by sheeting and pumping as required, or laying the pipe with a crushed stone bed so that the laying of pipe and other work can be done under stable conditions, all in accordance with Section 02240 of these Specifications.

B. Owner's Representative shall be notified immediately if such conditions are encountered onsite.

3.03 CLEANING OF DRAIN LINES:

A. Satisfactory precautions shall be taken to protect the drain lines at all times. All workmen shall be experienced and skilled in the use of the equipment used.

B. All sludge, dirt, sand, gravel, roots, grease, and other debris resulting from the cleaning operations shall be removed from the job site and disposed of by the Contractor.

C. A suitable weir or dam shall be constructed in a downstream manhole in such a manner that both solid and other material shall be trapped. Passing the material from one section to the next, which could cause blockage of the lines, shall not be permitted.

D. During bucketing operations, the Contractor shall provide a suitable container to receive materials dumped from the buckets. No solids removed from the lines, manholes, or catch basins shall be pumped or dumped onto streets or into ditches, catch basins, or other storm drains.

E. Upon completion of the cleaning of each section of drain line, a full-sized brush or scraper shall be pulled through the line to insure complete removal of all debris from the drain.

F. When the drain line flows are exceeding the minimum requirements (generally not more than one-fourth of the pipe diameter) or inspection of the complete periphery of the pipe is necessary, one or both of the following control methods shall be used. (This method to be used will be determined by the Owner's Representative, depending on the time needed for control.)

1. A line plug shall be inserted into the line at a manhole, drain basin, or clean out upstream from the section to be inspected. During the inspection of the section, the flow shall be reduced or shut off. After the inspection, the flow shall be returned to normal.

2. When adequate flow control cannot be obtained by plugging or blocking, pumps shall be used to bypass all or part of the flow. The cost of such bypass pumping shall be included in the bid, and no separate payment shall be made.

END OF SECTION

SECTION 02630

DRAINAGE STRUCTURES

PART I - GENERAL

1.01 SCOPE OF WORK:

A. The work to be done under this section shall include the installation of standard drainage structures as shown on the plans and specified under this item. The Contractor shall provide all material, labor, tools, equipment and transportation to complete these items. A grate or cover shall be provided for each structure.

B. Drainage structures shall be installed in the quantities and locations identified on the Contract Drawings. Contact the Project Representative if obstructions or conflicts are encountered.

1.02 REFERENCE STANDARDS AND SPECIFICATIONS :

A. Reference to the standards, specifications and tests of technical societies, organizations, and governmental bodies is made in the Contract Documents.

1. AASHTO - American Association of State Highway and Transportation Officials (tests or specifications).

2. ASTM - American Society for Testing and Materials.

3. Mass. Standard Specs. - Latest edition of the Standard Specifications for Highways and Bridges, the Massachusetts Highway Department, hereinafter referred to as "the Massachusetts Standard Specifications", Sections 2.01, M2.01 and M4.05 AND Plate #203.1.0 of the 1977 MDPW Construction standards.

4. Municipal Standard Specifications and Procedures, as applicable.

5. MAAB – Massachusetts Architectural Access Board

6. ADA – Americans with Disabilities Act

1.03 CODES, ORDINANCES AND PERMITS :

A. All work shall be performed in strict accordance with local and state codes and regulations.

1. Site utility work shall be done in strict accordance with the

Commonwealth of Massachusetts State Plumbing Code, dated September 1976, and all revisions thereto.

2. The Contractor shall secure all permits deemed necessary in connection with the installation of this equipment and pay fees required for same. He shall include the cost and back charge of installing any portion of the work where performed by municipal departments or utility companies.

1.04 SUBMITTALS/SHOP DRAWINGS:

A. Shop drawings shall be submitted to the engineer for all equipment. Copies shall be submitted and shall include cuts, scale drawings, installation details, manufacturer's specifications, certified performance characteristics and capacity ratings.

A. No material or equipment may be purchased or installed before the submission and written approval of the shop drawings.

PART II - MATERIALS

2.01 CLAY SEWER BRICKS (FOR ADJUSTING FRAMES) :

A. Clay sewer brick shall conform to the requirements of AASHO Designation M91 with the following exceptions:

1. The size of brick furnished shall be 8" x 3-3/4" x 2-1/4" nominal dimensions.

2. The average of the absorption of five (5) representative samples shall not exceed fifteen percent (15%) and the individual absorption of any one sample shall not exceed seventeen and one-half percent (17-1/2%). The average compressive strength of the five (5) representative samples shall not be less than three thousand (3,000) pounds per square inch and the compressive strength of any one sample shall not be less than two thousand-five hundred (2,500) pounds per square inch.

2.02 CEMENT MORTAR (FOR ADJUSTING FRAMES):

A. Mortar shall be composed of one (1) part of Portland cement and two (2) parts of sand by volume with sufficient water to form a workable mixture. Cement, sand and water shall conform to the applicable provisions of Mass. Standard Specifications, M4.02.15.

2.03 CEMENT CONCRETE :

A. Material shall comply with Section 03300 of these Specifications.

2.04 CASTINGS:

A. Iron castings (frames, grates and covers) shall conform to the MassDOT Construction Manual standard designs and to the requirements of AASHTO Designation M105, Class No. 30, Gray Iron Castings, unless otherwise specified. Test Bar B, 1.20 inches in diameter.

B. Beehive Frames and Grates for installation with catch basins in planted stormwater swales shall be Model R-2564 as manufactured by Neenah Foundry Company, 2121 Brooks Ave., Neenah, WI 54956, Toll Free 800-558-5075

2.05 DRAINAGE STRUCTURES AND DRAIN INLETS:

A. Drain inlets, Manholes and catch basins shall conform to the following specification:

B. PVC drainage structures shall be of the inline drain type as indicated on the contract drawings and referenced within the contract specification. Ductile iron grates for each of these fittings are to be used. The surface drainage inlets shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc., or approved equal. The drainage manholes and catch basins required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the furnished configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. The joint tightness shall conform to ASTM D3212 for joints or drain and sewer plastic pipe using flexible elastomeric seals. The pipe bell spigot shall be joined to the inline drain body by use of the swage mechanical joint. The pipe stock used to manufacture the inline drain body and pipe bell spigot of the surface drainage inlets shall meet the mechanical property requirements for fabricated fittings as described by ASTM D3034, Standard for Sewer PVC Pipe and Fittings; ASTM F1336, Standard for PVC Gasketed Sewer Fittings.

C. The grates furnished for all surface drainage inlets shall be ductile iron. Grates and covers for drains shall be capable of supporting H-25 wheel loading for heavy-duty traffic. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron.

2.06 SPECIAL MIX FOR SUBDRAINS:

A. Where designated, crushed stone for subdrains shall conform to the MHD

Standard Specifications M2.01.6.

B. A zone of crushed stone as shown in the details, meeting this specification, shall be placed around the entire perimeter of the subdrain structure.

PART III - EXECUTION

3.01 Structures of various types and depths shall be constructed to the line, grades, dimensions and design shown on the plans and as directed and furnished with the necessary frames, grates, covers, aluminum steps, etc., in accordance with these Specifications. Verify inverts of all utilities to remain.

3.02 The bricks and blocks (if required) shall be wetted as necessary before laying. All joints in brick masonry shall be thoroughly flushed full of mortar and no joints on the inside face shall be greater than one-quarter (1/4) inch. After the bricks and blocks are laid, the joints shall be pointed on the inside. As bricks or blocks are laid up, the outside of the structure shall be plastered with one-half (1/2) inch thick mortar coat.

3.03 Connections will be carefully made to all existing and proposed lines to the grades and elevations shown on the contract drawing.

3.04 Suitable materials obtained from the excavation or from borrow shall be placed between the outside of the structure and the limits of the excavation, uniformly distributed in successive layers not exceeding 6 inches in depth and thoroughly compacted by tamping with mechanical rammers or tampers. When required, the backfill material shall be moistened during the compacting. Compaction with iron hand tampers having a tamping face not exceeding twenty-five (25) square inches may be allowed, but only after permission has been given by the Engineer.

3.05 All materials removed in the excavation for catch basins, manholes, drop inlets, drywells, etc., and remaining after the filling about the finished structure has been made shall be used wherever possible within the project or removed and satisfactorily disposed of outside of the project limits without additional compensation.

3.06 Where directed, the castings shall be temporarily set at such grades as to provide drainage during the construction.

END OF SECTION

SECTION 02631

PRECAST MANHOLES AND CATCH BASINS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers all precast manholes and catch basins complete, including, but not limited to, bases, walls, cones, mortar, inverts, frames and covers.

1.02 RELATED WORK:

A. Section 02300, EARTHWORK.

B. Section 02755, BITUMINOUS CONCRETE

1.03 SYSTEM DESCRIPTION:

A. Precast sections shall conform in shape, size, dimensions, materials, and other respects to the details indicated on the drawings or as required by the Engineer.

B. All manholes and catch basins shall have concrete bases. Concrete bases shall be precast unless otherwise specified. Invert channels shall be formed of brick and mortar upon the base.

C. Catch basins shall have a 3-foot deep sump unless otherwise specified. Leaching basins shall have a bottom opening as shown on the drawings.

D. Riser and cone sections shall be precast concrete.

1.04 REFERENCES:

A. The following standards form a part of this specification as referenced:

American Society for Testing and Materials (ASTM)

ASTM	A48	Gray Iron Castings
ASTM	C32	Sewer and Manhole Brick
ASTM	C144	Aggregate for Masonry Mortar
ASTM	C207	Hydrated Lime for Masonry Purposes
ASTM	C478	Precast Reinforced Concrete Manhole Sections

ASTM C923 Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

ASTM C1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M198Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

Occupational Safety and Health Administration

OSHA 29 CFR 1910.27 Fall Prevention Protection

1.05 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Six sets of manufacturer literature of the materials of this section shall be submitted to the Engineer for review.

B. Tests reports as required shall be submitted to the Engineer.

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE SECTIONS:

A. All precast concrete sections shall conform to ASTM C478 with the following exceptions and additional requirements:

1. The wall thickness of precast sections shall be as designated on the drawings, meeting the following minimum requirements:

Section Diameter (Inches)	Minimum Wall Thickness (Inches)
48	5
60	6
72	7
84	8

2. Type II cement shall be used except as otherwise approved.

3. Sections shall be steam cured and shall not be shipped until at least five days after having been cast.

4. Minimum compressive strength of concrete shall be 4000 psi at 28 days.

5. No more than two lift holes may be cast or drilled in each section.

6. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.

7. Acceptance of the sections will be on the basis of material tests and inspection of the completed product.

8. Circumferential steel reinforcement in walls and bases shall be a minimum of 0.12 sq. in./lin. ft. for 4-foot diameter sections and 0.15 sq. in./lin. ft. for 5- and 6-foot diameter sections. Reinforcing shall extend into tongue and groove.

B. Conical reducing sections shall have a wall thickness not less than 5-inches at the bottom and wall thickness of 8-inches at the top. Conical sections shall taper from a minimum of 48-inches diameter to 24 or 30-inches diameter at the top, as shown on the drawings.

C. Except where insufficient depth of cover dictates the use of a shorter base, bases shall be a minimum of 4 feet in height.

D. Slab top sections and flat riser sections (Grade Rings) shall conform to the contract drawings, with particular attention focused upon the reinforcing steel and be designed to meet or exceed an H-20 Loading requirement.

E. The tops of the bases shall be suitably shaped by means of accurate ring forms to receive the riser sections.

F. Precast sections shall be manufactured to contain wall openings of the minimum size to receive the ends of the pipes, such openings being accurately set to conform with line and grade of the sewer or drain. Subsequent cutting or tampering in the field, for the purpose of creating new openings or altering existing openings, will not be permitted except as required by the Engineer.

G. "Drop-over" manholes shall be placed where indicated on the drawings. The Contractor shall accurately measure the diameter of the existing outlet pipe and inform the manufacturer of its size, so that the "Drop-over" type opening can be cut into the precast manhole base. The bottom shall be cast in place by the Contractor in accordance with Section 03300 CEMENT CONCRETE CAST IN PLACE. The invert channel shall be formed of brick and mortar, as specified in this specifications section. The sub-base shall be a compacted, level foundation of crushed stone, at least 6-inches thick, as specified in Section 02350, but shall vary to the depth necessary to reach sound undisturbed earth.

H. The exterior surfaces of all precast manhole bases, walls, and cones shall be given a

minimum of one shop coat of bituminous damp proofing.

I. The Engineer reserves the right to reject any unsatisfactory precast section and the rejected unit shall be tagged and removed from the job site immediately.

J. The Engineer may also require the testing of concrete sections as outlined under Physical Requirements in ASTM C478 with the Contractor bearing all testing costs.

2.02 BRICK MATERIALS:

A. Brick shall be sound, hard, and uniformly burned brick, regular and uniform in shape and size, of compact texture, and satisfactory to the Engineer. Bricks shall comply with ASTM C32, for Grade SS, hard brick, except that the mean of five tests for absorption shall not exceed 8 percent by weight.

B. Rejected brick shall be immediately removed from the work and brick satisfactory to the Engineer substituted.

C. Mortar shall be composed of portland cement, hydrated lime, and sand in which the volume of sand shall not exceed three times the sum of the volumes of cement and lime. The proportions of cement and lime shall be as directed and may vary from l:l/4 for dense hard-burned brick to l:3/4 for softer brick. In general, mortar for Grade SS Brick shall be mixed in the volume proportions of 1:1/2:4-1/2; portland cement to hydrated lime to sand.

D. Cement shall be Type II portland cement as specified for concrete masonry.

E. Hydrated lime shall be Type S conforming to ASTM C207.

F. The sand shall comply with ASTM C144 specifications for "Fine Aggregate," except that all of the sand shall pass a No. 8 sieve.

2.03 FRAMES, GRATES, COVERS AND STEPS:

A. Castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined to prevent rocking of covers.

B. All castings shall be thoroughly cleaned and may be subject to a careful hammer inspection at the Engineer's discretion.

C. Castings shall be ASTM A48 Class 30B or better.

D. The surface of the manhole covers shall have a diamond pattern with the cast words "WATER," "DRAIN" or "SEWER," whichever is appropriate.

E. Manhole frames with 32-inch covers for 30-inch openings shall be 500 pounds minimum by East Jordan Iron Works, No. LC328; Quality Water Products, Style 47; Neenah Foundry Co., R1740B or approved equal.

F. Watertight type manhole frames with 32-inch diameter covers (bolted and gasketed) shall be 4 bolt, 556 pounds minimum by East Jordan Iron Works, No. LCB328; Quality Water Products, Style C47WT; Neenah Foundary Co., R-17550-H or approved equal.

G. Manhole frames with 26-inch covers for 24-inch openings shall be 475 pounds minimum by East Jordan Iron Works No. LKll0A; Neenah Foundry Co. R1720; Quality Water Products, Style 40; or approved equal.

H. Watertight type manhole frames with 26-inch diameter covers (bolted and gasketed) shall be 4 bolt, 475 pounds minimum, and shall be East Jordan Iron Works No. LBB268; Mechanics Iron Foundry Type A2073; Quality Water Products, Style 40WT; or approved equal.

I. Frostproof manhole frames, with 26-inch diameter covers and inner lids, 435 pounds minimum, shall be R-1758 series by Neenah Foundry Co., Neenah, WI; LBF series by East Jordan Iron Works, Brockton, MA; B-3045 (or similar) by Mechanics Iron Foundry, Boston, MA; or approved equal.

J. 2-inch thick polystyrene insulation shall be firmly adhered to all frostproof inner lids.

K. Catch basin frames with 2-inch square openings and 23-7/8-inch square grates shall be 8-inches in height and 453 pounds minimum. They shall be Neenah Foundry Co. No. 3405; Quality Water Products No. 45; East Jordan Iron Works Type F; or approved equal.

L. Catch basin frames with bar grate openings and 23-7/8-inch square grates shall be 8-inches in height and 475 pounds minimum. Bar grates shall not be used in areas where bicycle traffic could be present. They shall be Neenah Foundry Co. No. R-3589; Quality Water Products No. 45; East Jordan Iron Works LK121; or approved equal.

M. Catch basin frames with cascade grate openings and 23-7/8-inch square grates shall be 8-inches in height and 512 pounds minimum. They shall be Neenah No. R-3589; Quality Water Products Mass Standard; East Jordan Iron Works LK121D; or approved equal.

N. Catch basin frames set against curbing shall have three flanges only.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. PRECAST SECTIONS:

1. Precast bases shall be supported on a compacted level foundation of crushed stone, as specified in Section 02350, EXCAVATION, BORROW, AND BACKFILL, at least 6-inches thick, but shall vary to the depth necessary to reach sound undisturbed earth.

2. Precast reinforced concrete sections shall be set vertical and with sections in true alignment.

3. Butyl rubber joint sealant shall be installed between each concrete section. Catch basin sections do not require joint sealant if so indicated on the drawings.

4. All holes in sections used for handling the sections shall be thoroughly plugged with mortar. Mortar shall be one part cement to 1-1/2 parts sand, mixed slightly damp to the touch (just short of "balling"), hammered into the holes until it is dense and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.

B. BRICK WORK:

1. Bricks shall be moistened by suitable means, as required, until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.

2. Each brick shall be laid as a header in a full bed and joint of mortar without requiring subsequent grouting, flushing or filling, and shall be thoroughly bonded as directed.

3. The brick inverts shall conform accurately to the size of the adjoining pipes. Side inverts shall be curved and main inverts (where direction changes) shall be laid out in smooth curves of the longest possible radius which is tangent to the centerlines of adjoining pipe.

C. CASTINGS:

1. Cast iron frames, grates and covers shall be as specified. The frames and covers shall be set by the Contractor to conform accurately to the grade of the finished pavement, existing ground surface, or as indicated on the drawings. Frames shall be adjusted to meet the street surface.

2. Cast iron manhole frames and covers not located in paved areas shall be set 6-inches above finished grade, at a height as required by the Engineer, or as indicated on the drawings. The top of the cone shall be built up with a minimum of 1 course and a maximum of 5 courses of brick and mortar used as headers for adjustment to final grade.

3. Frames shall be set concentric with the top of the concrete section and in a full

bed of mortar so that the space between the top of the concrete section or brick headers and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the concrete shall be placed all around the bottom flange. The mortar shall be smoothly finished to be flush with the top of the flange and have a slight slope to shed water away from the frame.

4. Covers and/or grates shall be left in place in the frames, for safety reasons, except while work is being performed.

D. ACCESSORIES:

1. Accessories shall be installed in accordance with manufacturer's instructions.

2. Stubs shall be set accurately to the dimensions indicated on the drawings. Stubs shall be sealed with suitable watertight plugs.

3.02 LEAKAGE TESTS:

A. Leakage tests shall be made by the Contractor and observed by the Engineer on each manhole. The test shall be by vacuum or by water exfiltration as described below:

B. VACUUM TEST:

1. The vacuum test shall be conducted in accordance with ASTM C1244. Test results will be judged by the length of time it takes for the applied vacuum to drop from 10 inches of mercury to 9 inches. If the time is less than that listed in Table 1 of ASTM C1244, the manhole will have failed the test. Test times from Table 1 are excerpted below.

TABLE 1

Minimum Test Times for Various Manhole Diameters

	Diameter (Inches)		
Depth (Feet)	48	60	72
		Times (Seconds)	
0-12	30	39	49
12-16	40	52	67
16-20	50	65	81
20-24	59	78	97
26-30	74	98	121

2. If the manhole fails the initial test, the Contractor shall locate the leaks and make

proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material. If the manhole should again fail the vacuum test, additional repairs shall be made, and the manhole water tested as specified below.

C. WATER EXFILTRATION TEST:

1. After the manhole has been assembled in place, all lifting holes shall be filled and pointed with an approved non-shrinking mortar. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent blow out. The test shall be made prior to placing the shelf and invert. 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.

2. 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 may be considered to be satisfactorily water-tight. If the test, as described above, is unsatisfactory as determined by the Engineer or 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 by the manhole. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and a measuring time of at least 8 hours begun. 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 loss rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed one gallon per vertical foot for a 24-hour period. If the manhole fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as required by the Engineer to bring the leakage within the allowable rate of one gallon per foot per day. Leakage due to a defective section or joint or exceeding the 3 gallon per vertical foot per day, shall be cause for rejection of the manhole. It shall be the Contractor's responsibility to uncover the rejected manhole as necessary and to disassemble, reconstruct or replace it as required by the Engineer. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed.

3. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc. It shall be assumed that all loss of water during the test is a result of leaks through joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the Engineer that the water table is below the bottom of the manhole throughout the test.

4. If the groundwater table is above the highest joint in the manhole, and there is no leakage into the manhole, as determined by the Engineer, such a test can serve to evaluate water-tightness of the manhole. However, if the Engineer is not satisfied with the results, the Contractor shall lower the water table and carry out the test as described hereinbefore.

3.03 CLEANING:

All new manholes shall be thoroughly cleaned of all silt, debris and foreign matter of any kind, prior to final inspection.

END OF SECTION

SECTION 02632

ADJUSTMENT OF STRUCTURES

PART I - GENERAL

1.01 GENERAL PROVISIONS:

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION I – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK:

A. Work under this section shall consist of removing the castings, adjusting the masonry, and resetting the castings of existing structures. The contractor shall furnish all labor, materials, equipment and transportation required to adjust existing manholes, catch basins, and other surface structures to be set at new grades.

1.03 REGULATIONS, FEES AND PERMITS:

1. All materials and the installation thereof shall conform to the requirements of all Federal, State and local laws, rules and regulations and codes pertaining thereto. Where Provisions of the Contract drawings conflict with any codes, rules and regulations, the laws, codes or regulations shall govern.

2. All legally imposed charges made by local authorities for the work of this Section involving the connection, inspection and approval services of all bureaus administering all applicable codes and regulations shall be provided hereunder at no additional expense to the Owner.

3. The Contractor shall give the proper authorities all required notices or information relating to work in his charge, pay all fees necessary to obtain all official licenses, permits and certificates, and comply with the rules of the Massachusetts Department of Public Safety.

PART II - MATERIALS

2.01 BLOCKS FOR CIRCULAR STRUCTURES:

A. Blocks for circular structures shall conform to ASTM C-139. Minimum thickness shall be eight (8) inches. Block surfaces shall be curved to the required radius to produce cylindrical structures. The minimum compressive strength for an average of three block units shall be 2,500 psi and the maximum water absorption rate shall be ten pounds per cubic foot.

2.02 BRICK FOR ADJUSTMENT COURSES :

A. Brick for adjustment courses and other application shall conform to ASTM C-32.

B. Brick for inverts and shelves shall be graded SS. Brick for other purposes shall be grade MS and better.

C. Size of brick shall be eight inches (8") long by three and three-quarter inches (3 ¾") wide, by two and one-quarter inches (2 ¼") deep. All dimensions shall be nominal.

2.03 MORTAR:

A. The mortar shall be composed of Portland cement, hydrated lime and sand in the proportions of 1 part cement to ½ part lime to 4-1\2 parts sand, (by volume). The proportion of cement to lime may vary from 1:1\4 for hard brick, but in no case shall the volumes of sand exceed three times the sum of the volume of cement and lime.

B. Cement: Cement shall be Type II Portland cement conforming to ASTM C-150, Standard Specifications for Portland Cement.

C. Hydrated Lime: Hydrated lime shall be Type S conforming to the ASTM Standard Specification for Hydrated Lime for masonry purposes, designation C-207.

D. Sand: Sand shall consist of inert natural sand conforming to the ASTM Standard for Concrete (fine) Aggregates, Designation C-33 as follows:

Sieve	% Passing
3/6	100
4	95-100
8	80-100
16	50-85
50	10-30
100	2-10

Fineness modules 2.3-3.1

PART III – EXECUTION

A. Structures to be adjusted shall be carefully excavated to the depth required to achieve the proper adjustments or to receive the appropriate filler pieces as required and securely held in place during backfilling operations. The backfill shall be thoroughly tamped in placed and the cover set to finished grade.

B. The Contractor shall be held responsible for the protection of all castings and valves or

other mechanical items. Any frames, grates or covers or operating items damaged in any manner during the progress of the construction shall be replaced by the Contractor at his expense.

C. Transportation, delivery and/or installation of all salvaged castings or mechanical items shall be included in the contract price.

END OF SECTION

SECTION 02635

STORMWATER TREATMENT SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install a structural underground stormwater oil and sediment separator and appurtenances in accordance with the Drawings and these specifications.

1.02 RELATED WORK:

A. Section 02300, EARTHWORK

B. Section 02745, PAVING

1.03 REFERENCES:

A. The following standards form a part of this specification as referenced:

American Society for Testing and Materials (ASTM)

ASTM D-4097	Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks
ASTM C478	Standard Specification for Precast Reinforces Concrete Manhole Sections
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. Shop Drawings

1. Shop Drawings consisting of catalog cuts or fabricator drawings showing the structure and frames, grates, or covers shall be submitted by the Contractor to the Engineer for approval.

2. Where an external bypass is required, the manufacturer must provide calculations and designs for all structures, piping, and other required material applicable to the proper functioning of the system, stamped by a Professional Engineer.

B. Affidavit on Patent Infringement

The Contractor shall submit to the Engineer, prior to installation of the stormwater treatment system, an affidavit regarding patent infringement rights stating that any suit or claim against the Owner due to alleged infringement rights shall be defended by the Contractor who will bear all the costs, expenses and attorney's fees incurred thereof.

C. Performance Documentation

The following documentation must be submitted by the Contractor and approved by the Engineer prior to the manufacture and delivery of any materials.

1. Laboratory Data

The stormwater treatment system supplier shall provide documentation of Total Suspended Solids (TSS) removal efficiency from laboratory testing conducted on the supplier's full-scale system. The documentation shall include:

a. TSS removal efficiency versus operating rate for the full operating range of the stormwater treatment system for a uniform 50-micron particle size.

b. TSS removal calculations for each system specified herein. The calculations must demonstrate that the system(s) is capable of achieving a net annual TSS removal efficiency as required by local regulations and as based upon a uniform 50-micron particle size and the best available rainfall data for the project site location.

2. Field Test Data

The stormwater treatment system supplier shall provide documentation of TSS removal efficiency from field testing conducted on an installed system. The documentation shall be in accordance with the following:

a. The testing and documentation shall have been conducted by an independent third party.

b. The testing and documentation shall include at least 10 storms.

c. The testing and documentation must show TSS removal results that meet or exceed the performance requirements for the system(s) specified herein.

3. Manufacturing Experience

The stormwater treatment supplier shall provide evidence of at least 5 years of successful product design and use. The supplier shall provide an installation list of

projects, model sizes installed and installation dates where the same type systems as specified herein have been designed and produced by the supplier.

D. Operation and Maintenance Manuals

Furnish four copies of the operation and maintenance manual for the stormwater treatment system.

PART 2 - PRODUCTS

2.01 GENERAL:

A. The separator shall be circular and constructed from pre-cast concrete circular riser and slab components. The internal fiberglass insert shall be bolted and sealed watertight inside the reinforced concrete component. The separator shall be capable to be used as a bend or junction structure within the stormwater drainage system.

2.02 PRECAST CONCRETE SECTIONS:

A. All precast concrete components shall be designed and manufactured to a minimum live load of AASHTO HS-20 truck loading or greater based on local regulatory specifications.

2.03 JOINTS:

A. The concrete joints shall be water-tight and meet the design criteria according to ASTM C-443. Mastic sealants or butyl tape are not an acceptable alternative.

2.04 FRAME AND COVER:

A. The frame and cover shall include an indented top design with lettering of the unit's name cast into the cover to allow for easy identification in the field.

2.05 CONCRETE:

A. All reinforced concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

2.06 FIBERGLASS:

A. The fiberglass portion of the water treatment device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

2.07 INSPECTION:

A. All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local specifications and ASTM C 478.

2.08 PERFORMANCE:

A. TOTAL SUSPENDED SOLIDS:

1. The treatment device shall be capable of removing 80 percent of the average annual total suspended solids (TSS) load without scouring previously captured pollutants.

2. Design methodologies shall provide calculations substantiating removal efficiencies and correlation to field monitoring results using both particle size and TSS removal efficiency.

3. All manufactures shall provide performance data that the stormwater quality treatment system does not scour previously captured pollutants based on the particle size distribution specified in section 3.5. Performance data should be laboratory testing with an initial sediment load of 50 percent of the unit's sediment capacity at an operating rate of 125% or greater. Particle size distribution (PSD) for the initial sediment load shall conform to Table 1.

B. FREE OIL

1. The separator must be capable of removing 95 percent of the floatable free oil.

2. The first 16 inches (405 mm) of hydrocarbon storage shall be lined with fiberglass to provide a double wall containment of the hydrocarbon materials.

C. PARTICLE SIZE

1. The separator must be capable of trapping fine sand, silt, clay and organic particles in addition to larger sand, gravel particles and small floatables.

2. The stormwater quality treatment device shall be sized to a specific particle size distribution that is clearly identified in both diameter and specific gravity. The example below is a Fine Particle Size that is a common PSD used in design of water quality devices to ensure proper design for capturing smaller particles and the high load of associated pollutants.

Table 1. Particle Size Distribution

Amount	Diameter	Specific Gravity
20%	20 micron	1.3
20%	60 micron	1.8
20%	150 micron	2.2

20%	400 micron	2.65
20%	2000 micron	2.65

PART 3 - EXECUTION

3.01 INSTALLATION:

A. The installation of the pre-cast concrete stormwater quality treatment device should conform to state highway, municipal or local specifications for the construction of manholes. Selected sections of a general specification that are applicable are summarized below.

3.02 EXCAVATION:

A. Excavation for the installation of the stormwater quality treatment device should conform to state highway, municipal or local specifications.

B. The stormwater quality treatment device should not be installed on frozen ground. Excavation should allow for adequate compaction around the structure. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

C. In areas with a high water table, continuous dewatering should be provided to ensure that the excavation is stable and free of water.

3.03 BACKFILLING:

A. Backfill material should conform to state highway, municipal or local specifications. Backfill material should be placed in uniform layers not exceeding 12 inches (300 mm) in depth and compacted to state highway, municipal or local specifications.

3.04 WATER QUALITY DEVICE CONSTRUCTION SEQUENCE:

A. The concrete water quality device is installed in sections in the following sequence:
- aggregate base
- base slab
- treatment chamber section(s)
- transition slab (if required)
- bypass section
- connect inlet and outlet pipes
- riser section and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

B. The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with gasketed joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

C. Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the stormwater quality treatment device has been constructed, any lift holes must be plugged with mortar.

3.05 DROP AND RISER PIPE:

A. Once the upper chamber has been attached to the lower chamber, the inlet drop tee, and riser pipe must be attached. Pipe installation instructions and required materials shall be provided with the insert.

3.06 INLET AND OUTLET PIPES:

A. Inlet and outlet pipes should be securely set into the upper chamber using non-shrink grout or approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight.

3.07 FRAME AND COVER OR FRAME AND GRATE INSTALLTION:

A. The grade adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

END OF SECTION

SECTION 02730

ACCESSIBLE TRAIL SURFACING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The work to be done under this Section shall be the furnishing, placement and compaction of accessible trail surfacing as shown on the drawings and as specified herein. The Contractor shall be responsible for supplying the material, labor, equipment and transportation necessary to do the work.

1.02 RELATED WORK:

A. Section 01330, SUBMITTALS

B. Section 02300, EARTHWORK

1.03 SAMPLES:

A. Prior to ordering and delivering materials to the site, (1) representative samples of accessible trail surfacing shall be sent to the Engineer for approval. The material shall be analyzed by a certified testing laboratory and certified by the supplier as a byproduct of a stone quarry operation.

B. The color shall be medium to dark gray when wet and consistent throughout. Samples must match that product which is to be installed.

1.04 TESTING:

A. Four samples each of materials requested to be tested by the Engineer shall be taken at the locations ordered by, and in the presence of, the Engineer at the site or at the source of supply and under his direction for testing in accordance with requirements stated herein. The Contractor shall pay for these tests regardless of their results.

B. Test results shall be submitted directly to the Engineer by a Certified Testing Laboratory to be approved by the Engineer. No material shall be re-used or furnished until the Engineer's approval is given.

C. All tests of any kind ordered by the Engineer shall be paid for by the Contractor regardless of test results.

PART 2 - PRODUCTS

2.01 ACCESSIBLE TRAIL SURFACING:

A. Accessible trail surfacing shall be the product of a 1/4” minus crushed rock derived from hard rock processed in a quarry and shall consist of inert materials that are hard, durable stone, free from surface coatings and deleterious materials. Processed bank run gravel or other materials containing insufficient fines are not acceptable.

B. Gradation requirements shall be as follows:

U.S. Sieve No.	Percent Passing by Weight
1/2”	95-100
3/8”	85-95
1/4"	60-75
#4	35-65
#16	20-40
#50	15-30
# 200	10-15

C. Compacted stone dust surfacing shall be ‘Crushed Schist’ as manufactured by John S. Lane & Son, Inc. West Stockbridge Quarry, MA or approved equal.

PART 3 - EXECUTION

3.01 PLACING AND COMPACTING:

A. The accessible trail surfacing shall be placed over a previously approved and installed compacted subgrade as detailed and as specified under Section 02300 of these Specifications. Subgrade surfacing shall be smoothed, flattened, and compacted, with no loose stone or debris present in the trail tread. Soft areas or voids shall be filled with crushed stone or gravel borrow and compacted. Apply geotextile fabric, as specified under Section 02300 of these Specifications.

B. The accessible trail surfacing shall be placed to the line and grades shown on the plans and shall consist of a minimum of the detailed thickness after watering and compacting to ninety-five percent (95%) of the maximum dry density of the material as determined by the Standard AASHTO Test Designation T99 compaction test Method C at optimum moisture content as determined by the Engineer. Accessible trail surfacing shall be uniformly mixed at optimum moisture content, spread, and compacted in lifts. The maximum thickness of any one lift shall be 3”

C. Compaction shall continue until the surface is even and true to the proposed lines and grades within a tolerance of three-eighths (3/8) inch above or below the required cross sectional elevations and to a maximum irregularity not exceeding three-eighths (3/8) inch under a ten (10) foot line longitudinally. Any specific area of material sub-base which, after being rolled, does not form a satisfactory, solid, stable foundation shall be removed, replaced and recompacted by the Contractor without extra compensation.

D. Obtain compaction using one of the following methods:

1. By hand, using non-mechanized compaction tools over the full area of each layer until visual displacement ceases;

2. By mechanical vibratory compactors over the full area of each layer until visual displacement ceases, but not fewer than three complete passes;

3. By using a roller or mechanical hand tamper until the density is at least 95 percent of the maximum density, as determined by AASHTO T99, Method.

E. Two or more wet dry/cycles are required to properly cure the accessible trail surface before compaction and stability testing can be performed.

END OF SECTION

SECTION 02755

BITUMINOUS CONCRETE PAVEMENT AND COLOR SEALCOAT

PART I - GENERAL

1.01 SCOPE OF WORK:

A. Under this Section, the Contractor shall furnish all necessary labor, materials, equipment, and transportation necessary to construct the following:

1. Bituminous concrete pavement shall be composed of materials as specified herein and shall be constructed on a prepared base course to the depth, grade and cross-section shown on the plans, as specified herein and as directed by the Engineer.

2. Unless otherwise specified in the Contract Drawings, bituminous concrete walkway pavement shall be composed of a one and one-half (1.5) inch bituminous concrete binder course, and a one and one half (1.5) inch bituminous concrete dense mix top course. Bituminous concrete vehicular pavement shall be composed of a two and one half (2.5) inch bituminous concrete binder course, and a one and one half (1.5) inch bituminous concrete dense mix top course.

3. Color sealcoating of bituminous concrete pavements as shown on the plans and as specified herein.

1.02 REFERENCE STANDARDS AND SPECIFICATIONS:

A. Reference to the standards, specifications and tests of technical societies, organizations and governmental bodies are made in the Contract Documents.

1. AASHTO - American Association of State Highway and Transportation Officials (tests or specifications).

2. ASTM - American Society for Testing and Materials.

3. Mass. Standard Specs. - Latest edition of the Standard Specifications for Highways and Bridges, MassDOT, hereinafter referred to as the "Massachusetts Standard Specifications."

1.03 SUBMITTALS:

A. Asphalt emulsion Type SS-1 product and application specification.

B. Color Sealcoat: The Contractor shall submit catalog cuts, manufacturer's specifications and color chips or charts.

C. Field layout of color sealcoat must be approved by Engineer prior to installation.

D. Submit catalog cuts and manufacturer's specifications for Airport Grade Asphalt Emulsion Mix and Aggregate.

E. Compaction tests are required on all bituminous concrete base surfaces on a 5' grid interval or per Owner's direction. At the Contractor's expense, an independent testing agency must perform the work and submit the results directly to the Engineer.

1.04 QUALIFICATIONS/SPECIAL REQUIREMENTS – COLOR SEALCOAT APPLICATION (ONLY WHERE SHOWN IN PLAN):

A. The Contractor shall engage the manufacturer's representative to inspect and monitor the application of the initial filler coat upon the prepared surfaces of all pavements to receive color sealcoat.

B. If a latex-ite acrylic sealer/surfacer is to be utilized, the addition of silica by mechanical agitation on-site shall be inspected and monitored by the manufacturer's representative who is to be engaged by the Contractor at the Contractor's cost.

C. Adequate means shall be provided to protect the color seal coating(s) from damage until such time that each layer has cured sufficiently and no seal will adhere to and be picked up by the tires of vehicles or by pedestrian traffic.

D. No color seal coating shall be applied during any period within which rain or sub-application temperatures are predicted within forty-eight (48) hours, unless otherwise specified by the manufacturer.

PART II – MATERIALS:

2.01 BITUMINOUS CONCRETE PAVEMENT

A. Bituminous Concrete Pavement shall consist of binder mix and dense mix courses constructed to the thicknesses shown on the plans and shall conform to the relevant provisions of Sections 460 and (M3.11.03) of the MassDOT Standard

Specifications for Highways and Bridges, Latest Edition, unless specified otherwise hereinafter.

B. Base/Binder Courses

1. Base/Binder Courses shall be Bituminous Concrete Pavement, Dense Finish Course Type I-1.

C. Leveling/Overlay Courses

1. Leveling/Overlay Courses may conform to "Surface Treatment" dense mix, Table A, Section M3.11.03 of the MassDOT Standard Specifications, comprised of Class I Dense Bituminous Concrete, Type St or Dense Mix Type I-1, at the Contractor's option.

2. The general composition of the bituminous concrete mixture (the proportion of asphalt cement to mineral aggregate) shall be in accordance with MHD requirements.

3. The mineral aggregate composition for Type St shall be as follows:

TYPE ST SIEVE ANALYSIS U.S. Standard Sieve No.	MINERAL AGGREGATE Percent Passing by Weight (per ASTM C-136)	
Size	Minimum	Maximum
1/2	100	-
3/8	80	100
4	55	80
8	48	63
16	36	49
30	24	38
50	14	27
100	6	18
200	4	8

2.02 ASPHALT EMULSION:

A. Asphalt emulsion tack coat shall be Type SS-1 or SS-1H as specified by the Asphalt Institute.

2.03 COLOR SEALCOAT:

A. The layout and design of color sealcoating shall be installed per contract drawings.

The two (2) filler coats shall be Plexipave as manufactured by California Products Corporation, 169 Waverly Street, Cambridge, Massachusetts, or approved equal. Colors shall be as indicated on the plans. The two (2) Plexipave filler coats shall be applied to the cleaned bituminous pavement as specified hereunder. It shall be non-flammable upon exposure to flame. The filler coats shall contain a minimum of 9 lb./gal. of Silica, 100 percent (100%) passing a 100% mesh as pre-mixed at the manufacturer's plant. No sand or silica shall be added to the emulsion in the field. The bituminous pavement shall cure for fourteen (14) days prior to applying the Plexipave Acrylic Color System. Colors shall be as selected by Engineer.

B. Water, if approved, may be added to the Plexipave emulsion mixes. In no case may the quantity of water in the filler coat emulsion mix exceed thirty-three percent (33%) of the emulsion volume. (One (1) part water: two (2) parts filler coat). In no case may the quantity of water in the finish coat emulsion mix exceed fifty percent (50%) of the emulsion volume. (One (1) part water: one (1) part finish coat). Water shall be potable and its temperature above forty degrees F (40ºF) upon addition to the emulsions.

C. The color emulsion coating shall be California Products Company's "Plexichrome" or an approved equal emulsion product. Colors shall match those of the Plexipave filler coats. The Plexichrome shall be applied lengthwise of the court with a wide type push broom.

D. The base vehicle for the finish coat shall be an acrylic polymer dispersed in water and which has the ability to withstand extremes in temperature and general weathering. The film former shall provide a non-skid surface upon drying and under all weather conditions. Pigment dispersions in the color coating are to be of the best quality chrome oxides so as to obtain a permanent true color. The coating shall contain no material, which will cause cracking due to extremes in temperatures and is to be factory mixed and consistent in color. It shall be a one hundred percent (100%) acrylic emulsion containing no alkyds, butadiene styrene, or vinyls and shall be thinned with water. It shall not chalk or discolor any equipment.

E. The finished surface shall be smooth and uniform, true to required grade and cross section, and free of depressions, ridges, or other irregularities.

PART III - EXECUTION

3.01 BITUMINOUS CONCRETE PAVEMENT:

A. Bituminous concrete pavements shall be constructed on a prepared foundation of gravel in accordance with the Massachusetts Standard Specifications, Section 405, except where overlayment is over existing pavement.

B. The bituminous mixtures shall be placed on the approved base only when, in the opinion of the Engineer, the course is sufficiently dry and weather conditions are suitable.

C. Where walls, curbing, or other suitable permanent supports are not present, the Contractor shall secure proper alignment and adequate compaction of the binder and surface courses as shown on the Contract Drawings and finish all edges with a neat tamped edge.

D. The mixture shall be placed in two (2) courses as shown on the Contract Drawings. Each course shall be spread and finished as required in the MassDOT Standard Specifications for Highways and Bridges, Section 460.63, latest edition.

E. After completion, the bituminous concrete courses shall conform to the thickness shown on the Contract Drawings, smooth and even and of a dense and uniform structure. When tested with a sixteen (16) foot straight edge placed parallel to the centerline of the pavement, there shall be no deviation from a true surface in excess of one-quarter (1/4) inch.

3.02 ASPHALT EMULSION TACK COAT:

A. To all existing surfaces to be paved against or overlaid, apply a single very thin (0.05 to 0.15 gallons per square yard) application of diluted asphalt emulsion (Type SS-1) to cover the entire surface of existing pavement.

B. Essential qualities of coverage are (1) it must be very thin and (2) uniformly cover entire surface of existing pavement.

C. Place only that amount of tack coat which can be overlaid with new pavement by the end of each day, and; **IF RAIN IS ANTICIPATED DO NOT APPLY TACK COAT.**

3.03 COLOR SEALCOAT:

A. The bituminous concrete pavement shall cure prior to applying the Color Sealcoat System in accordance with manufacturer recommendations.

B. The Contractor shall furnish and apply to the approved bituminous pavements so designated on the plans: two (2) filler coats and one (1) finish coat of acrylic emulsion color coating.

C. Prior to application of the filler coats, all dirt, sand, dust, and other loose material shall be cleaned from the paved areas to be covered, by sweeping and pressure washing with water. All surfaces shall be dry prior to starting any color seal coating process. The Contractor shall take special precautions to assure that

existing pavements are thoroughly cleaned and that all cracks or joints in existing pavements are repaired in conformance with these specifications and to the satisfaction of the Owner. Limits or areas to be color coated shall be taped with minimum two (2) inch wide tape true as to alignment prior to application of the color coating material.

D. The two (2) filler coats shall be applied so that both coats are of a total quantity and with a uniform spread at the rate of one (1) gallon per each one hundred (100) square feet of surface area. Additional filler coating material is to be used if necessary to complete the court surfaces satisfactory to the Supervisor. The first coat shall be applied length-wise of the court or drive and the second coat cross-wise of the court or drive.

E. After the filler coat applications have been completed and approved, apply one (1) acrylic color emulsion coating to the properly prepared surfaces with a uniform spread at the rate of one (1) gallon per each two hundred (200) square feet of surface area. The color emulsion coating shall be California Products Company's "Plexichrome" or an approved equal emulsion product. Colors shall match those of the Plexipave filler coats. The Plexichrome shall be applied lengthwise of the court with a wide type pushbroom.

F. The entire system of two (2) filler and one (1) finish coat shall be applied with approved squeegees and hair-type pushbrooms, respectively. The material shall be thoroughly mixed by mechanical agitation and all work shall be done in a thorough and workmanlike manner. The emulsion shall be thoroughly stirred in its container as received, by stationery bucket power mixer, so that a creamy, smooth consistency of all the emulsion in the container is assured for ready application. The entire work of color coat surfacing shall be done in accordance with the recommendations of the manufacturer's representative. Special care shall be taken so as to allow none of the material to spatter or flow beyond the perimeter of areas to be covered. The filler coats and finish coat shall not be applied in foggy or rainy weather, or when ambient temperature is below forty-five degrees F (45ºF), nor shall they be applied if such conditions are anticipated during the next forty-eight (48) hours.

G. The finished surface shall be smooth and uniform, true to required grade and cross section, and free of depressions, ridges, or other irregularities.

PART IV - GUARANTEE/WARRANTY

4.01 The Contractor shall be solely responsible for protecting color sealcoated surfaces until final acceptance of the project by the Owner and shall take all necessary precautions to secure premises during the initial drying periods.

4.02 The pavement and coatings shall be guaranteed against defects in workmanship or quality for a period of one (1) year after final acceptance. The Contractor shall replace, repair, recoat or otherwise make satisfactory to the Owner any unacceptable pavement and or coating at no additional cost to the Owner.

END OF SECTION

SECTION 02760

PAVEMENT MARKINGS

PART I - GENERAL

1.01 SCOPE OF WORK

a. The work of this Section consists of furnishing all labor, equipment, and materials necessary to paint all lines and symbols at the locations shown on the plans and in accordance with these Specifications, and to perform all layout necessary to accurately locate and paint lines and handicap parking symbols.

b. All parking stall lines shall be painted white.

PART II - MATERIALS

2.01 Materials shall meet the appropriate requirements specified in the following subsections of MassDOT, Division III, Materials:

General Requirements for Paints and Protective Coatings	M7.00.00
Yellow Thermoplastic Reflectorized Pavement Markings	M7.01.04
White Traffic Paint	M7.01.05
Glass Beads	M7.01.07
White High Heat Rapid Drying Traffic Marking Material	M7.01.08
Fast Drying White Traffic Paint	M7.01.10
Striping Powder	M7.01.12
Preformed Permanent Plastic Pavement Markings or Legends	M7.01.18
Thermoplastic Pavement Marking Compound, Alkyd	M7.01.20

PART III - EXECUTION

3.01 GENERAL:

a. All equipment used for the application of pavement markings shall be of standard commercial manufacture. All other equipment and devices necessary for the application of the pavement markings and protection thereof and for the protection to the traveling public shall be as usually required for work of this type and shall be furnished by the Contractor.

b. The pavement marking shall be operated at the speed and in accordance with other requirements of the manufacturer, unless otherwise directed by the Engineer.

c. Truck mounted equipment is approved for the application of pavement markings except in such cases where in the Engineer's judgment travel will

be unreasonably delayed and/or the quality of the work performed by the machine is unsatisfactory.

3.02 LAYOUT OF WORK:

a. A schedule of pavement marking operations shall be furnished by the Contractor for the approval of the Engineer prior to the application of any pavement markings. This schedule must be in the office of the Engineer 7 days prior to the proposed date of application of any pavement markings.

b. The Engineer will provide at a convenient location on the roadway a line of reference for use by the Contractor in establishing the location of markings. The line of reference shall be at a maximum of 50 foot intervals by means deemed satisfactory by the Engineer. All markings shall follow the line of reference without deviation. Any line deviating from the establishing control of incorrect width shall be reapplied, as directed by the Engineer in accordance with Subsection 860.62.

3.03 APPLICATION OF MARKINGS:

Pavement markings shall be applied as follows:

Material	Material Application Temperatur	Line Thickness	Reflectorized Bead Application
M7.01.05	l15°F-125°F	15 mils	6lbs/gal
M7.01.06	115 °F-125 °F	15 mils	6lbs/gal
M7.01.08	180°F-195°F	15 mils	6lbs/gal
M7.01.09	1800f"-195°F	15 mils	6lbs/gal
M7.01.10	40°F-120°F	15 mils	6lbs/gal
M7.01.11	40°F-120°F	15 mils	6lbs/gal
M7.01.03	400°F-425°F	128-188 mils	1 #/10 SF Drop on
M7.01.04	400°F-425°F	125-188 mils	1 #/10 SF Drop on

a. No thinners shall be used for the above listed pavement marking applications except in accordance with the manufacturer's specifications and at the direction of the Engineer.

b. No paint or pavement marking material shall be heated above the temperature marked on the container. Markings shall be applied only in seasonable weather and in accordance with good painting practices.

c. The surface shall be dry and free of sand, grease, oil or other foreign substances prior to the application. The Contractor shall prepare the surface to accept the

application as part of this item, with no additional compensation. The Engineer will make the final determination for all of the foregoing.

d. Bituminous concrete pavements shall have been in place for 48 hours prior to the application of pavement markings except preformed permanent plastic pavement markings which can be applied immediately. When it is necessary to expedite the flow of traffic, the Engineer may reduce the waiting period as is deemed necessary.

e. If for any reason material is spilled or tracked on the highway, or any markings applied by the Contractor, in the Engineer's judgment, fail to conform to Subsection 860.61, because of a deviation from the desired pattern, the Contractor shall remove such material by a method that is not injurious to the roadway surface and is acceptable to the Engineer, clean the roadway surface and prepare the surface for a reapplication of markings and reapply the markings as directed without additional compensation for any of the foregoing corrective operations.

f. The ambient (air) temperature for thermoplastic application is to be a minimum of 45 °F and rising at the time of marking operations. If work has started and air temperatures fall below 45 °F and continuous cooling is indicated, work shall be stopped. In cool weather conditions, temporary drops down to 40 °F will be tolerated, providing temperatures also vary upwards. Sustained striping (greater than one hour) at 40 °F shall not be allowed. Starting work at air temperatures lower than 45 °F shall not be allowed.

3.04 PROTECTION OF MARKINGS:

a. Markings shall remain protected until sufficiently dry to bear traffic on roadways that are open to traffic. Markings shall be protected by traffic cones of not less than 28 "in height except in the case of markings which cure to a no track condition in 180 seconds or less in the latter case protection may be provided by a convoy of vehicles with suitable warning devices to warn overtaking or on corning traffic that the pavement marking operation is in progress.

PART IV - GUARANTEE AND ACCEPTANCE

4.01 a. Painted lines shall be guaranteed for a period of one (1) year from final acceptance, against cracking, peeling, checking, or other defect. The Contractor will repair, recoat or otherwise make satisfactory, any failed lines, at no cost to the Owner.

- - - END OF SECTION - - -

SECTION 02773

CURBING

PART I- GENERAL

1.01 WORK INCLUDED:

A. Fabricate, furnish and install granite curbing, as indicated on the Drawings and as specified.

1.02 RELATED SECTIONS:

A. Section 02300- EARTHWORK

B. Section 02755 - BITUMINOUS CONCRETE PAVEMENT.

C. Section 03300 - CAST-IN-PLACE CONCRETE

1.03 REFERENCES:

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01420 - REFERENCES.

1. ASTM C 131 - Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
2. Commonwealth of Massachusetts Highway Department (MHD): Standard Specifications for Highway and Bridges

1.04 SUBMITTALS:

A. Submit the following under provisions of these specifications:

1. Submit complete shop drawings of each curb type and size for Engineer's approval.

1.05 QUALITY ASSURANCE:

A. Unless otherwise indicated, concrete curb materials and construction shall conform to the applicable portions of MHD's Standard Specifications Section 500, "Curb and Edging."

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Curb units shall be delivered to the job adequately protected from damage during transit.

B. Curb shall be protected against staining, chipping, and other damage. Cracked, badly chipped, or stained units will be rejected and shall not be employed in the work.

PART II - PRODUCTS

2.01 GRANITE CURB- VERTICAL:

A. Granite for vertical curb shall be engineering grade structural granite conforming to ASTM C615 requirements. Sizing of curb and comers shall be as shown on the Drawings. Granite curb shall be Type VA-4 as per the "Standard Specification."

B. Granite shall be of smooth splitting character and free from seams which impair its structural integrity. Natural variations characteristic of the deposit will be permitted. Granite shall come from an approved quarry.

C. Cement mortar shall meet requirements of Section M4, Paragraph M4.02.15 of the Standard Specifications. Color shall be “natural” to match color of curb.

D. Concrete shall be 4,000 psi concrete as specified under Section 03300 CONCRETE, herein.

E. Processed gravel fill as specified under Section 02300 EARTHWORK, herein.

PART III – EXECUTION

3.01 INSTALLATION - GRANITE CURBS:

A. Furnish and install new granite curb and reset existing granite curb removed and stockpiled for reuse, herein. Curb shall be set straight, plumb and as shown on the Drawings.

B. Curb shall be set in a concrete cradle in a trench excavated to a width of twenty-four inches (24"). The subgrade of the trench shall be at a depth below proposed finish grade of the curb equal to six inches (6") plus the depth of the curb stone. Base course shall then be filled with processed gravel fill to proper level to support curb at final grade and thoroughly tamped.

C. Place curb units in accurate line, each piece butting the next with joint spacing no larger than one-quarter inch (1/4). Final points shall be joined by closure pieces made to order. No curb shall be cut in the field. After alignment, the curb shall be carefully backfilled as shown on the Drawings. Extreme care shall be taken not to disturb alignment.

D. Patch street pavement as required.

END OF SECTION

SECTION 02782

CONCRETE PAVERS

PART I - GENERAL

1.01 SCOPE OF WORK

a. The Contractor shall furnish all labor, materials, equipment and transportation required to complete all improvements involving the placement and finished installation of concrete pavers according to the line and grade and details in the plans and to these Specifications herein.

b. In general, concrete pavers are to be placed at walkways in conformance with the applicable plans and details.

1.02 SAMPLES

a. Prior to ordering any materials, the Contractor shall submit representative samples to Landscape Architect for selection and approval. Do not order materials until Landscape Architect's approval has been obtained. Delivered materials shall closely match the approved samples.

1. <u>Concrete Pavers</u>

   The Contractor shall submit samples in a sufficient quantity to represent the full range of color variation that can be expected in the finished work, for each requested color, blend or type.

b. <u>Concrete Pavers Sample Panel</u>

1. Construct up to three (3) 4' x 4' sample panel of pavers on the specified sand setting bed and concrete base. The Landscape Architect must approve the quality of workmanship before the permanent pavement installation is started. If the samples are not approved, the Contractor shall provide additional samples, as required, at no cost to the Owner until an approved sample is obtained. The approved samples shall become the standard for concrete pavers for the entire job. The sample panels may be constructed on a location becoming part of the final pavement and shall remain undisturbed until all paving is completed. The Landscape Architect shall approve the area where the panel is to be constructed.

1.03 SHOP DRAWINGS

a. Submit shop drawings of all work of this Section. Obtain approval of shop drawings prior to proceeding with fabrication or ordering of materials.

b. Shop drawings and manufacturer's cut drawings shall include dimensions, sizes and thickness of members, details of construction, details of installation, relation to adjoining work, description of manufactured items, accessories and all other pertinent data for approval.

1.04 SHIPPING AND HANDLING OF MATERIALS

a. Not withstanding any prior acceptance of materials given prior to delivery, acceptance and approval for all work will be based upon the conditions at completion of installation.

b. It is the responsibility of the Contractor to exercise all necessary precautions to properly protect materials. Where damage occurs the items will be rejected.

1. Deliver packaged materials in manufacturer's unopened containers or bundles, fully identified with name, brand, type, weight and analysis. Store packaged materials in such a manner as to prevent damage or intrusion of foreign matter. Damaged or fractional packages shall be rejected.

2. Pavers shall be packaged by strapping to manufacturer's standard as delivered on pallets. Pavers damaged in any manner will be rejected and shall be replaced with new material at no additional cost to the Owner.

3. Store all pavers on raised platforms in such a manner as to prevent damage or intrusion of foreign matter. Storage piles or stacks shall be located to avoid or be protected from heavy and unnecessary traffic. Materials shall be stored under an approved roof or covered with waterproof tarpaulins, at all times, except when men are working and using the materials.

1.05 CLEANUP

a. After completion of all work, all debris, rubbish, and surplus materials shall be removed from the site. The site shall be left clean, presentable, and to the satisfaction of the Landscape Architect.

1.06 REFERENCE STANDARDS AND SPECIFICATIONS

a. Reference to the standards, specifications and tests of technical societies, organizations and governmental bodies are made in the Contract Documents.

1. AASHTO - American Association of State Highway and Transportation Officials (tests or specifications).

2. ASTM - American Society for Testing and Materials.

3. Mass. Standard Specs. - Latest edition of the Standard Specifications for Highways, Bridges and Waterways, 1988 Edition, the Commonwealth of Massachusetts, Department of Public Works, hereinafter referred to as "The Massachusetts Standard Specifications."

PART II - MATERIALS

2.01 CONCRETE PAVERS

a. Concrete pavers shall be provided in accordance with and manufactured by Pavestone, 18 Cowan Dr. Middleboro, MA 02346 (508-947-6001), or approved equal. The paver shall be City Stone Combo- 60mm, Natural Finish, Boston Blend.

b. The concrete pavers shall be made of normal weight aggregate. The average compressive strength of the test samples shall not be less than eight thousand five hundred (8,500) PSI. The absorption of the test samples shall not be greater than five percent (5%) as tested in accordance with ASTM C140.

c. The Contractor shall determine the quantity of pavers required for the project. The paving pattern detail on the drawings is presented to identify the general concept. Final paving solutions are the responsibility of the Contractor and subject to the approval of the Project Representative.

2.02 BEDDING SAND

a. As established by the manufacturer of the pavers, the bedding and jointing sand shall be clean, washed natural or manufactured concrete sand conforming to the table below. Sand shall be non-plastic and free from deleterious or foreign matter.

Grading Requirements for Bedding Sand
ASTM C 33

Sieve Size	Percent Passing
3/8 in. (9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	85 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (0.600 mm)	25 to 60
No. 50 (0.300 mm)	10 to 30
No. 100 (0.150 mm)	2 to 10

2.03 GRAVEL BORROW

a. As specified in Section 02300 of these Specifications.

2.04 DENSE GRADED CRUSHED STONE

a. Dense graded crushed stone, as required, shall be in accordance with Section 02300 of the Specifications.

2.05 CEMENT CONCRETE

a. Cement concrete for the pavement base shall be as specified in Section 03300 of these Specifications.

PART III - EXECUTION

3.01 SAND SETTING BED

a. After installation of the concrete base with weeps to the appropriate grades, place sand setting bed to achieve the compacted depth of two (2) inches after the pavers are vibrated into place at the specified finish grades.

3.02 INSTALLATION OF PAVERS

a. All pavers are to be set with zero clearance and the specified pattern alignment must be maintained. Adjust paver rows so that full pavers can be used to the greatest extent possible. Under any condition, no less than 1/3 of a full size paver will be permitted. All adjustment of pavers to the patterning will be done with a special hydraulic guillotine cutter.

b. Adjust any surface variations at this time and reinstall those areas so affected and re-vibrate.

c. Sweep sand over surface of pavers to fill any voids and mechanically vibrate a second time. Reapply sand for jointing as necessary to ensure adequate filling has been achieved. Methodology for compaction of pavers and vibration of sand for joints shall be as approved by the Project Representative and shall be performed in such a manner that caused no harm to finished surfaces.

d. All areas on which water stands or which are found to be excessively uneven shall be promptly brought to the correct grade and line.

e. No pavers shall be laid in inclement weather or when the temperature is thirty-six degrees F (36°F), and dropping, nor shall any work be done on rising temperatures until the temperature reaches thirty-two degrees F (32°F), and subgrade is free of frost.

f. The final surface elevation shall be adjusted so that when the pavers are placed, the top surface of the pavers will be at the required finished grade.

- - - END OF SECTION - - -

SECTION 02800

SITE FURNISHINGS

PART 1 – GENERAL:

1.01 RELATED DOCUMENTS:

A. The General Documents, as listed in the Table of Contents, and applicable parts of Division 1, General Requirements shall be included in and made a part of this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SCOPE OF WORK:

A. The work of this Section consist of all site improvements and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to, the following:

1. Benches with Back
2. Café Tables and Chairs
3. Bike Racks
4. Bleachers
5. Players Benches
6. Foul Poles
7. Baseball Bases, Home Plate, and Pitchers Rubber
8. Football/Soccer Combination Goal Posts
9. Basketball Posts and Goals
10. Tennis Nets, Posts, and Tie Downs
11. Scoreboards

1.03 RELATED WORK UNDER OTHER SECTIONS:

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Section 02350– Excavation, Borrow & Backfill
2. Section 03300– Cement Concrete

1.04 EXAMINATION OF CONDITIONS:

A. The Contractor shall fully inform himself of existing conditions of the site before submitting his bid, and shall be fully responsible for carrying out all site work required to fully and properly execute the work of the Contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct to the best of Engineer's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found therein.

1.05 SCHEDULING:

A. The Contractor shall submit to the Landscape Architect, for approval by the Owner, a progress schedule for all work as specified herein.

1.06 QUALITY ASSURANCE:

A. Materials and methods of construction shall comply with the following standards:

1. ASTM: American Society for Testing and Materials
2. ANSI: American National Standards Institute
3. FS: Federal Specifications
4. IMI: International Masonry Institute
5. PCA: Portland Cement Association

B. Qualifications of Workers: Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.

C. Layout: After staking out the work, and before beginning final construction, obtain the Landscape Architect's approval for layout. Contractor shall make adjustments as determined by the Landscape Architect. Landscape Architect may make adjustments to layout as is required to meet existing and proposed conditions without additional cost to the contract price.

1.07 SUBMITTALS:

A. Shop Drawings: Submit shop drawings in accordance with Division 1 requirements.

B. Product Information: Provide manufacturer's data showing installation and limitations in use. Supply Certificates of Compliance for all materials required for fabrication and installation, certifying that each material item complies with, or exceeds, specific requirements.

PART 2 – PRODUCTS:

2.01 BENCHES WITH BACK:

Benches with Back shall be Model CR-138, as manufactured by Victor Stanley, Inc. 1.800.368.2574, Dunkirk, MD 20754 or approved equal. Benches shall be six (6)feet in length and constructed of ¼" x 1 ½" solid steel slats with 1 5/16" tubular steel rung

supports. Finish shall be a baked-on polyester powder finish. Color shall be BLACK. All benches with back shall be surface mounted and include two end arm-rests and one center arm rest. All hardware shall be marine-grade steel conforming to AISI Type 304 and ASTM A193 latest requirements.

2.02 CAFÉ TABLES AND CHAIRS:

A. Café Tables shall be Model IPR-48, as manufactured by Victor Stanley, Inc. 1.800.368.2574, Dunkirk, MD 20754 or approved equal. Café Tables shall be 48" square and constructed of ¼" x 1 ½" solid steel slats with welded 1-5/16" tubular steel rung supports and 3/8" x 1" solid steel support bars. Café Table pedestal shall be 4" square tubular steel post. Finish shall be a baked-on polyester powder finish. Color shall be BLACK. All café tables shall be surface mounted. All hardware shall be marine-grade steel conforming to AISI Type 304 and ASTM A193 latest requirements.

B. Café Chairs shall be Model NRS-24, as manufactured by Victor Stanley, Inc. 1.800.368.2574, Dunkirk, MD 20754 or approved equal. Café Chairs shall be 24" wide and constructed of ¼" x 1 ½" solid steel slats with welded 1-5/16" tubular steel rung supports. Café Chair pedestal shall be 3" tubular steel post. Finish shall be a baked-on polyester powder finish. Color shall be BLACK. All café chairs shall be surface mounted. All hardware shall be marine-grade steel conforming to AISI Type 304 and ASTM A193 latest requirements.

2.03 BIKE RACKS:

Bike Racks shall be Model BRBS-103, as manufactured by Secure Site Design, LLC and Victor Stanley, Inc. (1.800.368.2574, Dunkirk, MD 20754 or approved equal. Café Tables shall be 32" height with 20" ring, and constructed of 3" tubular steel support with welded 1-5/16" solid steel ring. Finish shall be a baked-on polyester powder finish. Color shall be BLACK. All bike racks shall be surface mounted. All hardware shall be marine-grade steel conforming to AISI Type 304 and ASTM A193 latest requirements.

2.05 BLEACHERS:

Bleachers shall be five (5) row all-aluminum, 27'-0" in length each section, continuous seat and foot planks, "Standard" non-elevated model, as manufactured by National Recreation Systems, Inc., and as represented locally by M.E. O'Brien & Sons, Inc. (800-835-0056) or approved equal.

2.06 PLAYERS BENCHES:

Players benches shall 92" length, TenderTuff coated, 12-gauge perforated steel with roll-formed edges. Benches shall be equipped with back rest and shall be surface mounted. Benches shall be Model #141683 as manufactured by Landscape Structures, Inc., and as represented locally by M.E. O'Brien & Sons, Inc. (800-835-0056) or approved equal. Color to be selected by Engineer.

2.07 FOUL POLES:

Foul poles shall flagged and meshed baseball foul poles, 20' height, telescoping type post with 3-½ inch outside diameter at the base. Foul Poles shall be Model # BBFP-20 as manufactured by Jaypro Sports, Incorporated of Waterford, CT (800-988-3363), or approved equal.

2.08 BASEBALL BASES, HOME PLATE, AND PITCHER'S RUBBER

A. Baseball Bases shall be model #BB-500, Pro-Style Original Jack Corbett Base as provided by Jaypro Sports, Incorporated of Waterford, CT (800-988-3363), or approved equal.

B. Home Plate shall be model #HP-200, stanchion mounded with sleeve, as provided by Jaypro Sports, Incorporated of Waterford, CT (800-988-3363), or approved equal.

C. Pitcher's Rubber shall be 6" x 18", model # PR-618 with interior PVC tube, as provided by Jaypro Sports, Incorporated of Waterford, CT (800-988-3363), or approved equal.

2.09 FOOTBALL/SOCCER COMBINATION GOAL POSTS:

Football/Soccer Combination Goal Posts shall be comprised of 8'x24'x 10' x 4' soccer goal with European style backstays, and 10' x 23'-4" high school football uprights. Combination goal posts shall be constructed of 4" O.D. extruded aluminum posts and frame, with 2-3/8" O.D. aluminum uprights, and 2" O.D. backstays. Combination Goal post shall be powder coated. Combination Goal Posts shall be model FBSC-240EB as manufactured by Jaypro Sports, Incorporated of Waterford, CT (800-988-3363), or approved equal.

2.10 BASKETBALL POSTS AND GOALS

A. Basketball posts shall be 5-9/16" schedule 40 steel, gooseneck style with 6' extension. Posts shall be model #656 as manufactured by Jaypro Sports, Incorporated of Waterford, CT (800-988-3363), or approved equal.

B. Basketball goals shall 18" inside diameter, double ring goals constructed of two 5/8" O.D. steel rods with 3/16" steel brace mounting frame. Basketball goals shall be model UBG-500 as manufactured by Jaypro Sports, Incorporated of Waterford, CT (800-988-3363), or approved equal.

C. Basketball backboard shall be 36" x 54" x 1-1/2" case aluminum backboard with orange border target. Backboard shall be model # ALB-24BT as manufactured by Jaypro Sports, Incorporated of Waterford, CT (800-988-3363), or approved equal.

2.11 TENNIS POSTS, NETS, AND TIE DOWNS

A. Tennis posts shall be semi-permanent, 3" O.D. powder coated steel post with stainless steel self-locking internal wind assembly and ground sleeves. Tennis posts shall be "Courtmaster Royale" model #100-244 as manufactured by Har-Tru Sports, of Charlottesville, VA, (877-442-7878), or approved equal.

B. Tennis Nets shall be constructed of durable 3.5mm braided black polyethylene netting with quadruple stitched polycanvas headband with vinyl coated steel cable. Bottoms and edges shall be synthetic taped, with grommeted side pockets and 5/8" fiberglass dowels. Top five rows shall be double mesh. Tennis Net shall be "Courtmaster" model #105-711 as manufactured by Har-Tru Sports, of Charlottesville, VA, (877-442-7878), or approved equal.

C. Tennis Net Tie Down shall be 10"-long, 10GA galvanized steel with stainless steel pin. Center strap shall be adjustable, constructed of synthetic webbing with heavy-duty adjustable buckle and double bottom snap. Tennis Net Tie Down shall be "Heavy Duty Pipe Anchor" model #106-201, and Center Strap Model #106-754 as manufactured by Har-Tru Sports, of Charlottesville, VA, (877-442-7878), or approved equal.

2.12 SCOREBOARDS

A. Multisport Scoreboard shall be 4'-6" H x 16'-0" W x 8" D, with 24" LED digital read-outs for time and scores, and 18" LED digital read outs for period. Scoreboard shall display period time to 99:59, HOME and GUEST scores to 99, and Period to nine. Captions and lettering shall be vinyl. Score board shall be constructed of alcoa aluminum allow 5052, mounted on vertical steel I-beams with I-beam clamps. Scoreboard shall be hard wired. Multisport scoreboard shall be model # MS-2002 as manufactured by Daktronics, Bookings, SD (800-325-8766) or approved equal.

B. Baseball Scoreboard shall be 5'-0" H x 10'-0" W x 8" D, with 18" LED digital read-outs and 2" diameter indicators. Scoreboard shall display INNING to 19, HOME and GUEST scores to 99, BALL to three, STRIKE to two, and OUT to TWO. Captions and lettering shall be vinyl. Score board shall be constructed of alcoa aluminum allow 5052, mounted on vertical steel I-beams with I-beam clamps. Scoreboard shall be hard wired. Baseball scoreboard shall be model # BA-2618 as manufactured by Daktronics, Bookings, SD (800-325-8766) or approved equal.

PART 3 – EXECUTION:

3.01 INSTALLATION:

A. The installer shall examine previous work, related work, and conditions under which this work is to be performed and notify the Contractor in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means installer accepts substrates, subgrades, previous work, and conditions.

3.02 SITE FURNSHINGS:

A. Install each site furnishing in accordance with the Drawings and the manufacturer's instructions.

B. The Contractor shall be responsible for timing the delivery of site furnishings so as to minimize on-site storage time prior to installation. All stored materials must be protected from weather, careless handling and vandalism.

END OF SECTION

SECTION 02810

IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Work to be done includes furnishing all of the materials, labor, equipment and services to provide a complete, automatic landscape irrigation system as indicated on the Drawings, in these Specifications or both.

B. The mechanical point of connection for the irrigation system shall be to a new ground water well pump system to be provided as part of this contract. The system is designed for a maximum flow of 50 gallons per minute at a minimum of 75-psi dynamic pressure at the connection to the well pump discharge.

C. The electrical point of connection for the irrigation controller shall be to a new, dedicated, 120-volt, 20-amp electrical circuit provided to the irrigation controller by the site electrical contractor. The electrical point of connection for the ground water well pump system shall be to a new, dedicated, 240-volt, three phase electrical circuit provided to the pump control panel by the site electrical contractor.

D. The Drawings and Specifications shall be interpreted together and are intended to complement each other. The Contractor shall provide parts required by the Drawings and omitted in the Specifications, or vice versa, as if they were included in both. If the Contractor notices any discrepancies or has a question of intent, the Contractor shall notify the Irrigation Consultant and his decision shall be final and binding.

E. All necessary changes to the Drawings to avoid obstacles or to conform to the final landscape layout shall be made by the Contractor with approval by the Irrigation Consultant.

F. Work shall be done in a professional, workman like manner to the full intent of the Drawings and Specifications. The Contractor shall dispose of all waste generated by the construction of the irrigation system on a daily basis.

1.03 PRECONSTRUCTION SUBMITTALS

A. Product Data: For each type of product required, include rated capacities, operating characteristics and furnished specialties and accessories. Where multiple models are listed on a manufacturer's product data, clearly indicate the model being submitted.

B. Qualification Data:

1. Irrigation Contractor shall have a minimum of five (5) years of experience installing systems of similar size and complexity.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manual: The Irrigation Contractor shall provide three (3) binders labeled OPERATION AND MAINTENANCE INSTRUCTIONS FOR THE NEWTON HIGHLANDS PLAYGROUND IRRIGATION SYSTEM. The following information shall be included in the manual:

1. Owner's manuals indicating adjustment and maintenance for all components in the irrigation system

2. Copies of the Approved product submittals
3. One copy of the irrigation system Record Drawing
4. Winterization and Spring start-up procedures
5. Warranty information
6. Irrigation Contractor's contact information

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinklers and Nozzles: Equal to 1 percent of amount installed for each type and size indicated, but no fewer than 5 units of each.
2. Valves: 1 of each type (manual, automatic) and size indicated.
3. Quick Coupling Valve Keys: Equal to 1 key for every five quick coupling valves used on the project. Each key shall include a ¾-inch hose swivel.

1.06 DELIVERY, STORAGE, AND HANDLING

A. All materials are to be new and without flaws.

B. Maintain piping through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture. Piping shall not be stored directly on bare soil. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

C. Only store materials on site that are to be used for the construction of the system

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials to be utilized in this system shall be new and without flaws or defects and of quality and performance as specified and meeting the requirements of the system. All excess material at the completion of the installation are the property of the Contractor and shall be removed from the site.

B. No material substitutions from the products described in these Specifications and shown on the Drawings shall be made without prior approval and acceptance from the Irrigation Consultant.

2.02 PVC IRRIGATION PIPE

A. All pipe 2-1/2 inch and smaller shall be PVC, Class 200, Type 1120, SDR 21, Solvent-Weld PVC, conforming to ASTM No. D2241.

B. Pipe shall be as manufactured by Cresline, Texas United Pipe, JM or equal.

2.03 WIRE CONDUIT

A. Conduit for above and below ground wiring shall be Schedule 40 PVC electrical conduit, size as indicated on the details. Conduit shall be installed for all wire under non-soil areas and where indicated on the Drawings.

2.04 PVC PIPE SLEEVES

A. Sleeves shall be installed for all irrigation pipe and wire under non-soil areas and where indicated on the Drawings. Minimum sleeve size shall be three (3") inch Schedule 40 PVC.

2.05 PVC PIPE FITTINGS

A. Fittings for solvent weld PVC pipe shall be Schedule 40 solvent weld PVC fittings. Threaded fittings shall be Schedule 80 PVC.

B. PVC solvent shall be NSF approved, for Type I and Type II PVC pipe, and Schedule 40 fittings. Cement is to meet ASTM D2564 and FF493 for potable water pipes. PVC solvent cement shall be used in conjunction with the appropriate primer. Primer shall be purple primer complying with ASTM-F656.

C. Fittings for solvent weld PVC pipe shall be as manufactured by Dura, Lasco, Spears or equal.

2.06 VALVE BOXES

A. All valve boxes shall be manufactured from unformed resin with a tensile strength of 3,000-4,000 psi conforming to ASTM D638.

B. Valve boxes for single electric valves, isolation valves, quick coupling valves and wire splices shall be 10-inch round valve boxes.

C. Valve boxes for dual electric valves shall be 12-inch standard rectangular valve boxes.

D. All valve box covers shall have a Tee-shaped lid construction and capable of withstanding lawn tractor traffic.

E. Valve box extensions shall be provided as required.

F. Valve boxes shall be as manufactured by Pentek, NDS Pro Series, Carson Specification Grade or approved equal.

2.07 QUICK COUPLING VALVES

A. The valve body shall be of cast brass construction with a Working pressure of 125 psi. The valve seat disc plunger body shall be spring loaded so that the valve is normally closed under all conditions when the key is not inserted.

B. The top of the valve body receiving the key shall be equipped with a single slot and smooth face to allow the key to open and close the valve slowly with a one-half turn. The quick coupling valve shall be equipped with a locking vinyl cover.

C. The valve body construction shall be such that the coupler seal washer may be removed from the top for cleaning or replacement without disassembling any other parts of the valve.

D. Quick coupling valves shall be installed on one (1”) inch prefabricated PVC triple elbow swing joint. Swing joint shall be a minimum twelve (12”) inches in length. Installation shall be as per detail.

E. Keys shall be single lug with one (1”) inch male thread and three-quarter (3/4”) inch female thread at the top.

F. Quick coupling valves shall be as manufactured by Rain Bird model 44RC, Hunter Industries model HQ-44RC, Toro model 100-SLVC or approved equal.

2.08 ELECTRIC CONTROL VALVES

A. Electric control valves shall be molded valves with 24-volt solenoid, diaphragm type, fiberglass or reinforced nylon body plastic valves with manual flow control, manual bleed screw and 200 psi pressure rating. Valves shall be globe configuration.

B. Electric control valves shall be as manufactured by Rain Bird model PEB, Hunter Industries model ICV, Toro model P-220, or approved equal.

2.09 ISOLATION VALVES

A. Isolation gate valves 2½-inches and smaller shall be of bronze construction, US Manufacture, 600 WOG with steel cross handle and 200 psi rating as manufactured by NIBCO, Apollo, Watts or approved equal.

2.10 WIRE

A. The two-wire path shall be polyethylene double-jacketed or UF-B UL PVC double-jacketed two-conductor solid core designed for direct burial.

B. The conductors shall be #14AWG soft drawn, annealed, solid copper conforming to ASTM 33 (tinned or non-tinned).

C. Conductor insulation shall be 4/64-inch thick polyvinyl chloride (PVC), conforming to UL Standard #493 for thermoplastic-insulated style UF (Underground Feeder), rated at 60 degrees C.

D. The two insulated conductors are laid in parallel and encased in a single outer jacket of 3/64-inch thick, high-density, sunlight resistant polyethylene conforming to ICEA S-61-402 and NEMA WC5, having a minimum wall thickness of .045-inch.

E. The two conductors shall be color-coded: normally one conductor red and one black.

F. Both conductors shall be the same size.

2.11 LARGE ROTARY SPRINKLERS

A. The sprinkler shall be of the gear-driven, rotary type, capable of covering a 42-66 foot radius at 60 PSI with a discharge rate of 8.0-25.0 GPM. The sprinkler shall have radius adjustment capabilities by means of a stainless steel nozzle retainer/radius adjustment screw.

B. The sprinkler shall be both full-circle and adjustable part-circle operation in a single unit. The sprinkler shall be adjustable from 50° to 360°. It shall be adjustable in all phases of installation (i.e., before installation, after installation while static, and after installation while in operation). The sprinkler shall be equipped with a self-adjusting stator to ensure constant rotation speed regardless of nozzle installed.

C. The sprinkler shall have a non-strippable drive mechanism that allows the nozzle turret to be turned during operation, without damage. It shall also have an automatic arc return feature that returns the nozzle turret to its proper orientation if it is turned outside its intended arc of coverage.

D. The sprinkler shall be equipped with a drain check valve to prevent low head drainage, and be capable of checking up to 10 feet in elevation change.

E. The sprinkler shall have a minimum of 3-1/2-inch pop-up stroke from the cap to the rotating nozzle turret. The sprinkler shall have a rubber cover firmly attached to the top of the riser. The rubber cover shall be surrounded by a protective rubber boot when sprinkler is in the retracted position.

F. The sprinkler shall have a 1-inch Female National Pipe Thread (FNPT) inlet. The sprinkler shall be serviceable after installation by unscrewing the body cap, removing the riser assembly, and extracting the inlet filter screen.

G. The body and riser of the sprinkler shall be constructed of corrosion resistant, impact resistant, heavy-duty A.B.S. It shall have a stainless steel spring for positive retraction of the riser when irrigation is complete. The riser and nozzle-turret assembly shall be encased in stainless steel.

H. Large rotary sprinklers shall be installed flush to grade on one (1”) inch prefabricated PVC triple elbow swing joint assemblies with integral o-rings, minimum length 12 inches.

I. Sprinklers shall be manufactured by Toro model T7PSS-02, Hunter Industries model I25-04-SS, Rain Bird model 8005-SS, or approved equal.

J. Performance Chart (50 Foot Spacing)

Pattern	Toro T7PSS-02			Hunter I25-04-SS			Rain Bird 6504-SS		
	Nozzle	Flow	Radius	Nozzle	Flow	Radius	Nozzle	Flow	Radius
Q	#9	8.1	51’	#8	8.3	49’	#8	7.4	51’
H	#16.0	15.0	57’	#13	13.4	56’	#12	11.0	55’
F	#16.0	15.0	57’	#13	13.4	56’	#12	11.0	55’

2.12 MULTI-STREAM ROTATING NOZZLE SPRINKLERS

A. The sprinkler shall be capable of covering an 6-30 foot radius at 40-45 PSI. The sprinkler shall have a factory-installed drain check valve capable of checking up to 10 feet in elevation change.

B. The sprinkler shall have a standard pressure-regulating device as an integral part of the pop-up riser. This regulator will prevent fogging or misting of the nozzle spray pattern by maintaining a constant nozzle outlet pressure of 40-45 PSI with inlet pressures of up to 100 PSI, regardless of the nozzle installed.

C. The body of the sprinkler shall be constructed of corrosion and UV-resistant, heavy-duty A.B.S. The riser of the sprinkler shall be constructed of abrasion and UV-resistant A.B.S. and shall be adjustable for pattern alignment. The sprinkler shall have a stainless steel spring for positive retraction when irrigation is complete.

D. The sprinkler shall have a pressure-activated, multi-function, UV stable wiper seal that will clean debris from the pop-up stem while it retracts. The seal shall be molded around a rigid plastic ring to prevent seal deformation. This seal shall prevent the sprinkler from sticking in the up position and be capable of sealing the sprinkler riser stem to the sprinkler cap under normal operating pressures. The seal shall be removable from the cap for easy service and shall be replaceable.

E. Mount small sprinklers on an 18” maximum length of ½” polyethylene tubing. Tubing to withstand 400 psi burst test and shall have a wall thickness of 0.1”. Fittings for tubing shall be compatible and made by the same manufacturer.

F. Sprinklers for turf areas shall have a 6-inch pop-up height. Sprinklers for groundcover and shrub areas shall have a 12-inch pop-up height.

G. Sprinklers shall be manufactured by Hunter Industries, model PROS-06/12-PRS40-CV, Rain Bird model 1800-SAM-PRS45, or approved equal.

H. Nozzles shall be as manufactured by Hunter Industries models MPCORNER, MPLCS515, MPRCS515, MPSS530, MP800, MP1000, MP2000 and MP3000.

2.13 AUTOMATIC CONTROLLER

A. The controller shall have a minimum of four independent programs with minimum four start times per program. Any two programs shall have the capability of running concurrently. Watering times shall be available from 1 minute to 12 hours in 1-minute increments per station.

B. Controller shall operate a two-wire path and valve decoders and have a maximum station capacity of 200.

C. Controller shall have seasonal adjust, cycle and soak, and flow management features.

D. Controller shall include a lockable weather proof enclosure with internal transformer. Controller shall have a station capacity to include one station per electric control valve plus a minimum of two spare stations.

E. Controller shall be as manufactured by Rain Bird model ESP-LXD, Hunter Industries model I-CORE-DUAL, or approved equal.

2.14 CONTROLLER ENCLOSURE

A. The enclosure shall be of a vandal and weather resistant nature manufactured entirely of stainless steel. The main housing door shall be louvered at the bottom and equipped with a tear drop shaped, hollow center thermoplastic door seal. The entry lid shall be louvered on the back side to allow for cross flow ventilation. Filter screens shall cover all louvers to deflect against water spray, insects and dust.

B. The top entry lid shall be assisted by two gas springs for easy access. The edge of the lid shall be hemmed to eliminate any sharp edges. The top entry lid shall have a continuous stainless steel piano hinge, carriage bolted on the rear, and a three-point locking mechanism on the front. A stainless steel cam style lock shall be mounted in the lid and a provision for a padlock shall be included within the locking mechanism.

C. A removable stainless steel tray shall be provided for the purpose of mounting electronics and various other types of equipment. A removable stainless steel backboard shall be provided in the lower body and mounted on four stainless steel bolts. The inside door area shall provide adequate storage for plans, operating instructions, and scheduling information.

D. The above described product shall be a NEMA TYPE 3R Rainproof Enclosure as listed by Underwriter Laboratories, Inc.

E. The enclosure shall be 22” Wide, 38” High, 15.5 Deep.

F. The enclosure shall be as manufactured by V.I.T. Products model SB-22SS or approved equal.

2.15 DECODERS

A. The valve decoders shall be fully sealed, submersion proof, and direct bury to effectively seal moisture from the electronics and installed per manufacturer’s specifications, and as specified herein.

B. The valve decoder shall have one to four built-in serial numbers with the first address listed on the side of the decoder.

C. Each valve decoder shall come with 24 inches of 16-gauge PVC jacketed solid core wire to connect to the two-wire.

D. Each valve decoder shall come with 24 inches of 18-gauge PVC jacketed stranded core wire to connect to the valve wire.

E. Decoders shall be as manufactured by same manufacture of chosen controller and be compatible with chosen controller.

2.16 MASTER VALVE

A. The valve shall be hydraulically operated, single diaphragm-actuated, globe or angle pattern. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.

B. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.

C. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast Ductile Iron material. No fabrication or welding shall be used in the manufacturing process

D. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.

E. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off.

F. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.

G. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully opened or fully closed position.

H. The pressure reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall include a fixed orifice. No variable orifices shall be permitted. The pilot system shall include an opening speed control as standard equipment.

I. The pilot control shall have a second downstream sensing port which can be utilized to install a pressure gauge.

J. The valve shall include a 3-way Nema IV 24 VAC solenoid to intercept the pressure reducing control to close/open the main valve. The solenoid shall have a warranty of 1 year.

K. Valve shall be 2-inches in size and be of normally open configuration.

L. Valve shall be as manufactured by CLA-VAL, model 93-01 or approved equal.

2.17 FLOW METER

A. Flow meter shall be 1½-inch in size mounted in a Schedule 80 PVC tee. Flow meter shall be removable from the tee and held in place with a retaining nut. Flow meter shall have a rated working pressure of 150psi and a recommended flow range of 0.25–12fps.

B. Flow meter shall have an accuracy better than ±1% within recommended flow range and repeatability better than ±0.3% within recommended flow range.

C. Flow meter impeller shall be high density polyethylene, shaft shall be tungsten carbide and have a BUNA N o-ring.

D. Flow meter shall be compatible with the irrigation control system.

2.18 AUTOMATIC RAIN SENSOR (RAIN BIRD CONTROLLER ONLY)

A. The rain sensor shall be plastic in construction and have adjustable interrupt settings from 1/8” to 1”. Sensor shall wirelessly communicate with a receiver mounted at the controller.

B. Sensor shall be as manufactured by Hunter Industries model WR-CLIK, Irritrol model RS1000, Rain Bird model WR2-RC, or approved equal.

2.19 AUTOMATIC WEATHER SENSOR

A. The weather sensor shall have a rain sensor with adjustable interrupt settings from 1/8” to 1”, a temperature sensor and a solar sensor. The weather sensor shall wirelessly communicate with a receiver mounted at the controller providing weather data that the controller will utilize to adjust irrigation run times.

B. Sensor shall be as manufactured by Hunter Industries model SOLAR-SYNC, Rain Bird model ET-MANAGER, or approved equal.

2.20 GROUNDING EQUIPMENT

A. Use grounding electrodes that are UL listed or manufactured to meet the minimum requirements of Article 250-52 of the 2002 edition of the NEC. At the very minimum, the grounding circuit will include a copper clad steel ground rod, a solid copper ground plate and 100 pounds of earth contact material.

B. The copper grounding plate assemblies must meet the minimum requirements of Article 250-52(d) of the 1999 NEC. They are to be made of a copper alloy intended for grounding applications and will have minimum dimensions of 4” x 96” x 0.0625”. A 25-foot continuous length (no splices allowed unless using exothermic welding process) of 6 AWG solid bare copper wire is to be attached to the plate by the manufacturer using an approved welding process. This wire is to be connected to the electronic equipment ground lug as shown in the detail.

C. Grounding equipment shall be as manufactured by Paige Electric Company or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

A. The Consultant shall make frequent observations of the Contractor's work while such work is in progress. The Consultant shall bring to the attention of the Contractor any work which does not meet the specifications of the contract and the Contractor shall correct such work as brought to his attention.

B. Staking of sprinkler locations shall be done by the Contractor and approved by the Consultant. Location shall be according to the plans provided with field modifications to adjust for local conditions and actual plant locations, both existing and proposed. Coordinate with other trades (landscaping and other site Work trades). The Contractor shall be responsible for full and complete coverage of all irrigated areas and shall make any necessary minor adjustments. The Irrigation Contractor shall coordinate with the Landscape Contractor to ensure that the irrigation system conforms to the landscape layout. Major changes shall be reviewed with the Consultant prior to proceeding. The Contractor shall denote all changes on the Record Drawings in accordance with Contract Documents.

C. At all times, protect existing irrigation, landscaping, paving, structures, walls, footings, etc. from damage. Any inadvertent damage to the Work of another trade shall be reported and repaired at once.

3.02 PIPE AND FITTINGS INSTALLATION

A. The Contractor shall have all utilities located prior to beginning trenching. The Contractor shall exercise reasonable care to avoid causing damage to any and all underground utilities and structures. It is the Contractor's responsibility to locate and to protect all utilities. Any damage to utilities shall be corrected and paid for by the Contractor.

B. All excavation shall be unclassified and shall include all materials encountered except materials which cannot be excavated by normal mechanical excavation means. Such exceptions shall be brought to the attention of the Consultant and an adjustment in price shall be agreed upon before excavation of these areas proceeds. Such price adjustments and agreement shall include responsibility for disposal of the unsuitable materials removed from the trench and the acquiring of additional backfill materials.

C. On existing sodded areas, sod shall be removed, preserved, and replaced once backfilling is accomplished.

D. If trenching is necessitated through existing asphalt roadways, the Contractor shall saw cut asphalt to the width of the trench prior to trenching unless noted otherwise on the plan. Removal of cut asphalt and replacement of all asphalt shall be the responsibility of the Contractor. No trenching shall be done in existing asphalt or concrete paving without prior approval from the Consultant.

E. Using proper width trencher chain, excavate a straight and true trench to a depth of 2-inches below pipe invert elevation.

F. Loam encountered within the limits of trench excavation for irrigation mains and branch lines shall be carefully removed to the lines and depths as shown on the Drawings and stockpiled for subsequent replacement in the upper 6 inches of the trench from which it is excavated. Such removal and replacement of the quantities of loam shall be considered incidental to the irrigation system and no additional compensation will be allowed.

G. Pipe shall be laid on undisturbed trench bottom provided suitable base is available with no rock larger than 1 inch or sharp edges; if not, excavate to 2 inch below pipe invert and provide sand base or 95% compacted soil upon which to lay pipe.

H. Backfilling shall be accomplished as follows: the first 10-inch of backfill material shall contain no foreign matter and no rock larger than 1 inch in diameter. Carefully place material around pipe and wire and tamp in place. Remainder of backfill shall be placed in (6”) six inch maximum lifts and tamped to compaction with mechanical equipment matching adjacent undisturbed area. Frozen material shall not be used for backfill.

I. Make all solvent-weld joints in strict accordance with manufacturer's recommendations, making certain not to apply an excess of primer or solvent, and wiping off excess solvent from each connection. Allow connections to set minimum 24 hours before pulling or pressure is applied to the system. Provide for expansion and contraction as recommended.

J. Mainline pipe shall have minimum 24 inches of COVER (excavate to invert as required by pipe size). Lateral pipe shall have minimum 18 inches of COVER (excavate to invert as required by pipe size).

K. Cut plastic pipe with handsaw or pipe-cutting tool, removing all burrs at cut ends. All pipe cuts are to be square and true. Bevel cut end, as required, to conform to Manufacturer's Specifications.

L. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. At times when installation of the piping is not in progress, the open end(s) of the pipe shall be closed by a watertight plug or other means. All piping, which cannot temporarily be joined, shall be sealed to make as watertight as possible. Pipe not to be installed that day shall not be laid out. Should water enter the trench during or after installation of the piping, no additional piping may be installed or back filled until all water is removed from the trench. Pipe shall not be installed when water is in the trench, when precipitation is

occurring, or when the ambient temperature is at 35 degrees F or below. PVC pipe shall be snaked in the trench to accommodate for expansion and contraction due to changes in temperature.

M. In installing irrigation pipe the Contractor shall route the pipe as necessary to prevent damage to tree roots. Where trenching must occur near trees, the Contractor shall provide proper root pruning and sealing methods to all roots 1 inch and larger.

N. Throughout the guarantee period it will be the responsibility of the Contractor to refill any trenches that have settled due to incomplete compaction.

O. All PVC may be installed by standard trenching techniques. Plowing or pulling in of pipe will be allowed provided the proper installation depth can be maintained.

P. Lateral pipes and fittings shall be installed in accordance with the manufacturer's recommendations, including the snaking-in of the PVC pipe to accommodate for expansion and contraction due to changes in temperature.

3.03 ELECTRICAL WIRE CONDUIT INSTALLATION

A. Electrical conduit shall be installed for all above ground wiring to controller and rain sensor and for wiring installation below non-soil areas.

3.04 PIPE SLEEVING INSTALLATION

A. Contractor shall be responsible to coordinate installation of required sleeves beneath pavement. Sleeves shall have a minimum cover of 24-inches (excavate to invert as required). Sleeves are to be provided for all piping installed below non-soil areas.

3.05 ISOLATION VALVE INSTALLATION

A. Install isolation valves on mainline per detail where indicated on the Drawings. Install specified valve box over each mainline isolation valve.

3.06 VALVE BOX INSTALLATION

A. Furnish and install a valve access box for each electric valve, quick coupling valve, isolation valve, air/vacuum relief valve, manual drain valve and wire splice.

B. The valve box lid shall be set flush with the adjacent grade.

3.07 QUICK COUPLING VALVE INSTALLATION

A. Provide quick coupling valves where indicated on the Drawings.

B. Quick coupling valves shall be installed on one (1”) inch prefabricated PVC triple elbow swing joint with stabilizer. Swing joint shall be a minimum twelve (12”) inches in length. Installation shall be as per detail.

3.08 24 VOLT CONTROL VALVE INSTALLATION

A. Control valves shall be set plumb with adjusting handle and all bolts, screws and wiring accessible through the valve box opening.

B. Adjust zone valve operation after installation using flow control device on valve.

3.09 WIRING INSTALLATION

A. Wiring shall be installed along with the mainline. Multiple wire bundles shall be laid beside, and at the same invert as, the irrigation lines. Sufficient slack for expansion and contraction shall be maintained and wiring shall at no point be installed tightly. Provide an additional 8 inches to 12 inches slack at all changes of direction. Wiring in valve boxes shall be a sufficient length to allow the valve solenoid, splice, and all connections to be brought a minimum of two feet above grade for servicing. This additional slack shall be coiled for neatness in the valve box. Each valve shall have a separate wire back to the controller.

B. All wire shall be laid in trenches and shall be carefully back-filled to avoid any damage to the wire insulation or wire conductors themselves. In areas of unsuitable material, the trench shall have a 2 inches layer of sand or stone dust on the bottom before the wires are laid into the trench and back-filled. The wires shall have a minimum of 12 inches of cover when installed in a separate trench from the irrigation piping. Wire not to be installed that day shall not be laid out.

C. An expansion curl shall be provided within 6 inches of each wire connection to a solenoid and at least every 100 feet of wire length on runs more than 100 feet in length. Expansion curls can be formed by wrapping five (5) turns of wire around a 1-inch diameter or larger pipe, then withdrawing the pipe.

D. Provide control wiring for 24-volt service in accordance with the Drawings and state and local codes. All in-ground wire connections shall be made with wire nuts and a waterproof connection. All splices shall be made in valve boxes (wire runs requiring splices between valve locations shall be provided in splice box). Splice locations shall be shown on the Record Drawings.

E. Contractor shall provide a complete wiring diagram showing wire routing for the connections between the controller and valves. See section one for the inclusion of wiring diagram in operation and maintenance manuals.

3.10 CONTROLLER INSTALLATION

A. Install controller where indicated on the drawings. Coordinate location with electrical contractor to ensure proper location of the electrical circuit and wire controller to 120-volt electrical supply.

B. Wire valves and sensors to controller and set proper program.

C. Keys shall be turned over to Owner's Representative.

3.11 CONTROLLER ENCLOSURE INSTALLATION

A. Enclosure shall be installed on a 24-inch wide by 24-inch long by 8-inch thick concrete base. Provide one 1-inch conduit for controller electrical service, one 1½-inch conduit for controller grounding and one 2-inch conduit for controller valve wiring through concrete base. Conduits to have long radius sweep ells and extend 18-inches beyond the extents of the concrete base.

3.12 SPRINKLER INSTALLATION

A. Large rotary sprinklers shall be installed flush to grade on 1-inch prefabricated PVC triple elbow swing joint assemblies with integral o-rings, minimum length 12 inches.

B. Mount small rotary sprinklers and spray sprinklers on an 18” maximum length of ½” polyethylene tubing. Tubing to withstand 400 psi burst test and shall have a wall thickness of 0.1”. Fittings for tubing shall be compatible and made by the same manufacturer.

C. Staking of sprinkler locations shall be done by the Contractor and approved by the Owner’s Representative. Location shall be according to plans provided with field modifications to adjust to local conditions and actual plant locations, both existing and proposed. The Contractor shall be responsible for full and complete coverage of all irrigated areas and shall make any necessary minor adjustments.

3.13 GROUNDING EQUIPMENT

A. Ground rods are to be driven into the ground in a vertical position or an oblique angle not to exceed 45 degrees at a location 10 feet from the electronic equipment, the ground plate, or the wires and cables connected to equipment, as shown in the detail.

B. The ground plate is to be installed to a minimum depth of 30”, or below the frost line if it is lower than 30”, at a location 8 feet from the electronic equipment and underground wires and cables. Two 50-pound bags of earth contact material must be spread so that it

surrounds the copper plate evenly along its length within a 6” wide trench. Salts, fertilizers, bentonite clay, cement, coke, carbon, and other chemicals are not to be used to improve soil conductivity because these materials are corrosive and will cause the copper electrodes to erode and become less effective with time.

C. Install all grounding circuit components in straight lines. When necessary to make bends, do not make sharp turns. To prevent the electrode-discharged energy from re-entering the underground wires and cables, all electrodes shall be installed away from said wires and cables. The spacing between any two electrodes shall be as shown in the detail, so that they don’t compete for the same soil.

D. The earth-to-ground resistance of this circuit is to be measured using a Megger®, or other similar instrument, and the reading is to be no more than 10 ohms. If the resistance is more than 10 ohms, additional ground plates and earth contact material are to be installed in the direction of an irrigated area at a distance of 10’, 12’, 14’, etc. It is required that the soil surrounding copper electrodes be kept at a minimum moisture level of 15% at all times by dedicating an irrigation station at each controller location. The irrigated area should include a circle with a 10-foot radius around the ground rod and a rectangle measuring 1-foot X 24-feet around the plate.

E. All underground circuit connections are to be made using an exothermic welding process. Solder shall not be allowed to make connections. The 6 AWG bare copper wires are to be installed in as straight a line as possible, and if it is necessary to make a turn or a bend it shall be done in a sweeping curve with a minimum radius of 8” and a minimum included angle of 90°. Mechanical clamps are not permitted.

3.14 TESTING AND SYSTEM

A. Testing System: Upon completion of the irrigation system and after sufficient time has been allowed for solvent weld joints to cure, the entire system shall be tested for proper operation. All air will be flushed from the system and the Contractor will check all components for proper operation.

B. Balancing and Adjustment: The Contractor shall balance and adjust the various components of the sprinkler system so the overall operation of the system is most efficient. This includes a synchronization of the controllers, adjustments to pressure regulators, pressure relief valves, part circle sprinkler heads, and individual station adjustments on the controllers.

C. Operational Testing: Perform operational testing after hydrostatic testing, backfill is in place, and sprinkler heads are adjusted to final position. Demonstrate to Owner that the completed system meets coverage requirements and that automatic controls function properly.

D. Final Grades at Heads: After completion of grassing, planting and mulching and settlement with establishment of the final grades, carefully adjust all irrigation equipment so it will be flush with or not more than 1/4" above grade.

E. Notice of Substantial Completion:

F. When the Contractor is satisfied the system is operating properly, and all work and clean-up is completed, then he shall issue the notice of substantial completion to the Owner no less than ten (10) working days prior to requested review. The notice of completion shall include the request for final inspection on which date and time will be given.

G. Final Inspection with Consultant: The Consultant will respond to the notice of completion by the Contractor and shall appear at an agreed upon time for the final inspection. The Consultant shall note any inconsistencies on the plans or specifications and a written copy of corrections shall be given to the Contractor.

H. Guarantees: The Work included under this contract shall be guaranteed by the Contractor against all defects and malfunctions due to faulty workmanship or defective material for a

period of one year from the date of substantial completion as deemed by the Owner. Upon being informed by the Owner of any defects or malfunctions, the Contractor shall make all necessary repairs and/or replacements within 48 hours maximum at no additional cost to the Owner. The Owner may make emergency repairs, when necessary, without relieving the Contractor of his guarantee obligation. The Contractor shall be obligated to repair any settling of backfilled trenches, which may occur during the guarantee period. The Contractor is also obligated to restore any and all damaged plantings, paving, or improvements due to trench settlement or repairs within the year period.

3.15 CLEANING AND ADJUSTING

A. Adjust sprinkler heads, valve boxes, and quick coupling valves to grade as required to avoid damage by mowing operations.

B. Continue sprinkler coverage adjustment as required by settlement, etc., throughout the guarantee period.

C. Each control zone shall be operated for a minimum of 5 minutes and all heads checked for consistency of delivering water. Adjustments shall be made to sprinklers that are not consistent to the point that they match the manufacturer's standards. All sprinklers, valves, timing devices or other mechanical or electrical components, which fail to meet these standards, shall be rejected, replaced and tested until they meet the manufacturer's standards.

D. Upon completion of all installation Work, Contractor shall remove all leftover materials and equipment from the site in a safe and legal manner.

3.16 ACCEPTANCE AND OPERATION BY OWNER’S REPRESENTATIVE

A. The Contractor shall provide and keep up to date a complete set of record drawings which shall be corrected daily to show changes in sprinkler locations, controller locations, wire sizes and locations, piping locations, pipe sizes, and any deviations from the original irrigation design drawing as provided to him. All isolation valve locations, backflow prevention, water meters, and quick couplers shall be shown with actual measurements to reference points so they may be located easily in the field.

B. Upon completion of the work, the Contractor shall furnish the Owner with a complete set of record drawings showing the irrigation system as installed.

C. The Contractor shall furnish, in addition to the Record Drawings and operational manuals, copies of all available specification sheets and catalog sheets to the Owner's personnel responsible for the operation of the irrigation system. The Contractor shall guarantee all parts and labor for a minimum period of one (1) year from date of substantial completion.

END OF SECTION 02810

SECTION 02811

IRRIGATION WELL PUMP SYSTEM

PART 1 - GENERAL

1.1 GENERAL

A. The Drawings and Specifications must be interpreted and are intended to complement each other. The Contractor shall furnish and install all parts, which may be required by the Drawings and omitted by the Specifications, or vice versa, just as though required by both. Should there appear to be discrepancies or question of intent, the Contractor shall refer the matter to the Consultant for decision, and his interpretation shall be final, conclusive and binding.

B. The Work shall be constructed and finished in every respect in a good, Workmanlike and substantial manner, to the full intent and meaning of the Drawings and Specifications. All parts necessary for the proper and complete execution of the Work, whether the same may have been specifically mentioned or not, or indicated on the Drawings, shall be done or furnished in a manner corresponding with the rest of the Work as if the same were specifically herein described.

1.2 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements that affect the Work of this Section.

1.3 EXISTING CONDITIONS

A. The Contractor shall fully inform himself of existing conditions on the site before submitting his bid, and shall be fully responsible for carrying out all Work, required to fully and properly execute the Work of the Contract, regardless of the conditions encountered in the actual Work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed, except those conditions described in the GENERAL CONDITIONS.

1.4 SCOPE

A. Contractor shall provide and install a ground water well pump system. Contractor shall provide all labor, materials, equipment and services to complete the Work of this as indicated on the Drawings, specified herein, or both.

B. The electrical point of connection for the irrigation pump system shall be to a new 240-volt, three phase electrical service provided by the electrical contractor to the electrical disconnect on the exterior of the pump system control panel.

C. An extended pumping test shall be performed on the existing ground water well lasting a minimum of 24 hours to determine the elevation below grade and the flow rate that the well can sustain under continuous pumping conditions. After the pumping has stopped, the water level shall be monitored for a minimum of 6 hours (unless water level returns to the elevation recorded prior to pumping commencing) to determine the recovery rate of the well.

1.5 ORDINANCES, PERMITS AND FEES

A. The Work under this Section shall comply with all ordinances and regulations of authorities having jurisdiction.

B. The Contractor shall obtain and pay for any and all permits, tests and certifications required for the execution of Work under this Section.

C. Furnish copies of Permits, Certifications and Approval Notices to the Owner's Representative prior to requesting payment.

1.6 QUALITY ASSURANCE

A. Installer: A firm, which has at least five (5) years of experience in Work of the type and size as required by this Section and which is acceptable to the Owner's Representative.

B. References: Upon Request, the Contractor must supply three references for Work of this type and size including names and phone numbers of contact person(s).

C. Applicable requirements of accepted Standards and Codes shall apply to the Work of this Section and shall be so labeled or listed:

1. 1. American Society for Testing & Materials (ASTM)
2. 2. National Plumbing Code (NPC)
3. 3. National Electric Code (NEC)
4. 4. National Sanitary Foundation (NSF)
5. 5. American Society of Agricultural Engineers (ASAE)
6. 6. Underwriters Laboratories, Inc. (UL)
7. 7. Occupational Safety and Health Regulations (OSHA)

1.7 TESTS

A. Observation: The Owner’s Representative will be on site at various times to insure the system is being installed according to the Specifications and Drawings.

B. Operational Test: After completion of the system, test the operation of entire system and adjust as directed by the Owner's Representative. Demonstrate to the Owner's Representative that all is operating as designed and specified (See Part 3 Execution).

1.8 PRECONSTRUCTION SUBMITTALS

A. Product Data: For each type of product required, include rated capacities, operating characteristics and furnished specialties and accessories. Where multiple models are listed on a manufacturer’s product data, clearly indicate the model being submitted.

B. Qualification Data:

1. Contractor shall have a minimum of five (5) years of experience installing systems of similar size and complexity.

1.9 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manual: The Irrigation Contractor shall provide three (3) binders labeled OPERATION AND MAINTENANCE INSTRUCTIONS FOR THE NEWTON HIGHLANDS IRRIGATION WELL PUMP SYSTEM. The following information shall be included in the manual:

1. Owner’s manuals indicating adjustment and maintenance for all components in the irrigation system
2. Copies of the Approved product submittals
3. One copy of the pump system Record Drawing
4. Winterization and Spring start-up procedures
5. Warranty information
6. Contractor’s contact information

1.10 WARRANTY

A. Contractor shall warranty all material and work for a period of one year after final acceptance. Warranty shall include one winterization and one spring start-up.

PART 2 - MATERIALS

2.1 GENERAL

A. The pump system shall be capable of providing 50-gpm at a pressure of 75-psi (175 feet) at the pump system point of connection to the irrigation system. The pump shall operate at no more than 3600 RPM. The power supply to the station shall be 240-volt, three phase electrical service.

B. Operational sequence: The pump shall activate automatically upon detecting a drop in pressure in the irrigation main line. Operation shall be maintained at an adjustable minimum demand. The pump shall be automatically retired when the demand falls below the minimum adjustable set point for an adjustable time delay.

2.2 PUMP AND MOTOR

A. PUMP: Pump shall be submersible type and have a cast 304 stainless steel discharge head and motor adapter. Bearings shall be replaceable silicon carbide. Pump shall have a built in check valve and stainless steel impellers, suction screen, fasteners and cable guard. Pump shall have a removable stainless steel, splined coupling.

B. MOTOR: Pump motor shall be designed to NEMA standards, have stainless steel casing, water filled design to provide a constant supply of lubrication, hermetically sealed stator, durable Kingsbury type thrust bearing and replaceable motor lead assembly.

2.3 PIPING

A. All piping shall galvanized steel and conform to ASTM specifications A53 for Grade B welded or seamless schedule 40 pipe. All fittings shall be seamless, ASTM Specification A234, with pressure rating not less than 150 PSI.

2.4 STATION DISCHARGE ISOLATION VALVE

A. Isolation gate valves shall be of bronze construction, US Manufacture, 600 WOG with steel cross handle and 200 psi rating as manufactured by NIBCO, Hammond Valve, Watts or approved equal.

2.5 PRESSURE GAUGE

A. Pressure gauge shall be located downstream of the pump for easy reading of the discharge pressure. Pressure gauge shall be 304 stainless steel case and bezel construction. Gauge shall be 2-1/2" diameter, liquid filled. Pressure sensing connection shall be 1/4" NPT lower gauge connection.

2.6 GENERAL PANEL

A. The low voltage control panel assembly shall be built in accordance with the provisions of the National Electrical Code and shall bear the U.L. listing mark for NEMA 3R industrial control panels along with the pump station manufacturers' U.L. panel shop file number. The control panel shall be pedestal mouont and contain terminal blocks, relays, and HOA switch.

2.7 MAIN STATION DISCONNECT AND FUSING

A. A three-pole, service rated main station disconnect shall be mounted in a separate NEMA 4 enclosure outside the pump station enclosure to completely isolate the pump station electrical system from incoming power.

2.8 PRESSURE TRANSDUCER

A. A solid state pressure transducer shall provide a noise free, linear output proportional to discharge pressure. Transducer shall be solid state, strain gauge type with integral voltage regulating and output accuracy not less than 0.5%. Transducer shall be constructed of stainless steel and rated for the maximum pump station discharge pressure.

2.9 VARIABLE FREQUENCY DRIVE (VFD)

A. The variable frequency drive shall be IGBT based with selectable carrier frequency up to 15 KHZ.

The VFD shall include terminals for incoming power, motor output power and control terminals. The VFD shall generate a sine-coded, variable voltage/frequency, three-phase output for optimum speed control. The VFD shall incorporate power loss ride-through. VFD protective features shall include current limit, short circuit protection, electronic motor overload protection and ground fault protection. The VFD shall have push button programming display for easy access to operation parameters. VFD must be designed for operation in 50 degree C temperature condition.

2.10 CONTROL ALARMS

A. Low System Pressure Safety Shutdown

1. When the station discharge pressure remains below an adjustable set point for more than 2 minutes, the pumps will be de-energized and remain so until the alarm is manually reset. The Low Pressure alarm will be indicated on the processor display.

B. High System Pressure Safety Shutdown

1. When the station discharge pressure remains above an adjustable set point for 2 minutes, the pumps will be de-energized and remain so until the alarm is manually reset. The High Pressure alarm will be indicated on the processor display.

C. Motor Overload Shutdown

1. If the over current condition lasts longer than the pre-programmed limit the motor will be de-energized and remain so until the alarm is manually reset. The overload alarm will be indicated on the processor display.

D. VFD Fault Shutdown

1. The VFD shall sense additional internal faults that will cause the VFD to shutdown for system protection. These faults will be indicated on the processor display.

2.11 LIGHTNING ARRESTOR

A. The main power supply to the pump station shall be equipped with a secondary lighting arrestor having a breakdown current rating of not less than 60,000 Amps at 14,000 Volts discharge. Power supplies 300 Volts and less shall use a 300 Volt arrestor with an 800 Volt spark-over Voltage. Power supplies up to 600 Volts shall use a 600 Volt rated arrestor with a 1,000 Volt spark-over Voltage.

2.12 SUBMERSIBLE PUMP WIRE

A. Wire for submersible pump shall be three conductor plus ground twisted submersible cable. Conductors shall have PVC insulation and be colored black, red, yellow and green. Conductors shall be rated 600V, type THW submersible cable. Cable shall be UL Listed. Cable shall be properly sized for the pump horsepower.

B. Wire type and method of installation shall be in accordance with local codes for NEC circuits of 600-volt A.C.

2.13 ELECTRICAL CONDUIT

A. Conduit for below ground wiring shall be PVC Schedule 40, sizes as indicated on the drawings and details.

2.14 WELL PUMP ENCLOSURE

A. The well pump enclosure shall be of a vandal and weather resistant nature manufactured entirely of marine grade aluminum alloy 5052-H32, with a wall thickness of one eighth inch. The mounting base shall be manufactured entirely of stainless steel.

B. The main housing shall be of solid sheet construction with screened louvers for ventilation. The enclosure shall be a center split design, having mounting lips on each end. The mounting base shall be submerged into the concrete a minimum of two inches, positioning the enclosure one

and one half inches above the concrete for drainage purposes. Enclosure shall have a flexible rubber skirt to prevent wind intrusion.

C. The locking mechanism shall be of the full release type which allows for complete removal of the enclosure from its mounting base without the use of tools. The locking mechanism shall be a Stainless Steel Cross Bar style and provide for a padlock.

D. Enclosure shall be 40-inches long by 38-inches wide by 39-inches tall as manufactured by VIT Products, model PE-40AL or approved equal.

2.15 CHECK VALVE

A. Check valve shall be of brass or bronze construction and be swing type opening when water is flowing in the designed direction and closing when water reverses flow or flow stops. Check valve shall be rated 200-psi WOG.

PART 3 - EXECUTION

3.1 GENERAL

A. The Consultant shall make frequent observations of the Contractor's work while such work is in progress. The Consultant shall bring to the attention of the Contractor any work which does not meet the specifications of the contract and the Contractor shall correct such work as brought to his attention.

B. The well drilling contractor shall be responsible for providing and installing the proper well casing and screen for the geology encountered.

3.2 PUMP INSTALLATION

A. Well pump shall be installed in well per AWWA standards and utilize proper torque arrestors as required. Pump shall be wired to the control panel and piped to the control components as shown on the Drawings.

3.3 ISOLATION VALVE, PRESSURE TRANSDUCER, PRESSUR GAUGE, CONTROL PANEL

A. Pump discharge isolation valve, check valve, pressure transducer and control panel shall be installed in pump enclosure as shown on the Drawings.

3.4 TESTING AND SYSTEM

A. Testing System: Upon completion of the pump system, the entire system shall be tested for proper operation. All air will be flushed from the system and the Contractor will check all components for proper operation.

B. Adjustment: The Contractor shall adjust the various components of the pump system so the overall operation of the system is most efficient.

C. Operational Testing: Perform operational testing after irrigation system is completed and connected to the pump system. Demonstrate to Owner that the completed system meets operational requirements and that automatic controls function properly.

D. Notice of Substantial Completion: When the Contractor is satisfied the system is operating properly, and all work and clean-up is completed, then he shall issue the notice of substantial completion to the Owner no less than ten (10) working days prior to requested review. The notice of completion shall include the request for final inspection on which date and time will be given.

E. Final Inspection with Consultant: The Consultant will respond to the notice of completion by the Contractor and shall appear at an agreed upon time for the final inspection. The Consultant shall note any inconsistencies on the plans or specifications and a written copy of corrections shall be given to the Contractor.

F. Guarantees: The Work included under this contract shall be guaranteed by the Contractor against all defects and malfunctions due to faulty workmanship or defective material for a period of one year from the date of substantial completion as deemed by the Owner. Upon being informed by the Owner of any defects or malfunctions, the Contractor shall make all necessary repairs and/or replacements within 48 hours maximum at no additional cost to the Owner. The Owner may make emergency repairs, when necessary, without relieving the Contractor of his guarantee obligation. The Contractor shall be obligated to repair any settling of backfilled trenches, which may occur during the guarantee period. The Contractor is also obligated to restore any and all damaged plantings, paving, or improvements due to trench settlement or repairs within the year period.

3.5 CLEANING AND ADJUSTING

A. Upon completion of all installation Work, Contractor shall remove all leftover materials and equipment from the site in a safe and legal manner.

3.6 ACCEPTANCE AND OPERATION BY OWNER’S REPRESENTATIVE

A. The Contractor shall provide and keep up to date a complete set of record drawings.

B. Upon completion of the work, the Contractor shall furnish the Owner with a complete set of record drawings showing the well pump system as installed.

C. The Contractor shall furnish, in addition to the Record Drawings and operational manuals, copies of all available specification sheets and catalog sheets to the Owner's personnel responsible for the operation of the pump system. The Contractor shall guarantee all parts and labor for a minimum period of one (1) year from date of substantial completion.

END OF SECTION 02811

SECTION 02820

BLACK VINYL CLAD CHAIN LINK FENCE AND GATES

PART I - GENERAL

1.01 SCOPE OF WORK

A. The work under this Section consists of furnishing and installing vinyl coated chain link fence fabric and hardware and framework of various heights as shown on the Contract Drawings and as specified herein including all labor, materials and equipment necessary to finish the work complete in place.

1.02 REFERENCE STANDARDS

B. References herein to any technical society, organization, group or body is made in accordance with the following abbreviations:

1. ASTM American Society for Testing Materials

2. AWS American Welding Society

1.03 QUALITY ASSURANCE

A. All fencing shall conform to the specifications of the Chain Link Fence Manufacturer's Institute and as specified herein.

1.04 SUBMITTALS

Per Section SPECIAL CONDITIONS of these Specifications, submit:

A. Three (3) samples, approximately 3" long or 6" square of fabric material, post sections and typical accessories.

B. Shop drawings or catalog cuts including details illustrating fence height, fence post spacing, and sizes of posts, rails, braces, footings, gates and all accessories.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material in manufacturer's original packaging with all tags and labels intact and legible. Handle and store material in such a manner as to avoid damage.

PART II - MATERIALS

2.01 VINYL CLAD STEEL POSTS, RAILS AND BRACES

A. General

1. All fence pipe for posts, rails, and all braces and appurtenances shall be vinyl clad, schedule 40 round, seamless hot dip galvanized pipe conforming to ASTM-A-120-1, or approved equal.

2. All structural shapes shall be vinyl clad, and galvanized in conformance with ASTM Designation A123.

3. All vinyl clad materials shall be fusion bonded in accordance with ASTM-F668 Class 2B.

B. End, Corner and Pull Posts

1. Fence up to and including 5'-0" in height: 2.375"O.D. pipe, 3.65 lbs. per linear foot.

2. Fence over 5'-0" in height: 2.875" O.D. pipe, 5.79 lbs. per linear foot.

3. Fence over 10'-0" in height: 4.00" O.D. pipe, 9.11 lbs. per linear foot.
4. Maximum Spacing 10’-0” on Center.

C. Line Posts (10'-0" Maximum Spacing)

1. Fence up to 5'-0" in height: 1.90" O.D. pipe, 2.28 lbs. per linear foot.

2. Fence over 5'-0" in height: 2.375" O.D. pipe, 3.12 lbs. per linear foot.

3. Fence over 10'-0" in height: 2.875" O.D. pipe, 5.79 lbs per linear foot.

D. Gate Posts

1. Gate posts for single leaf gates six (6) feet or less in width: 2.875" O.D. pipe, 4.64 lbs. per foot min.

2. Gate posts for single leaf gates six (6) to twelve (12) feet in width: 4.00" O.D. pipe, 6.56 lbs. per foot.

E. Rails

1. All rails shall be 1.66" O.D. pipe weighing 2.27 lbs. per linear foot furnished in manufacturer's standard lengths of approximately 21'-0" with

outside sleeve type couplings, at least six (6) inches long for each joint – one (1) coupling in each five (5) to have expansion spring. Provide means for attaching rails securely to each corner, pull and end post. Rails shall form continuous brace from end to end of each run of fence.

F. Post Bracing Assembly

1. 1.66" O.D. pipe weighing 2.27 lbs. per linear foot (for horizontal braces). Provide at each side of corner and pull posts and at end posts for fence six (6) feet or higher.

2.02 CHAIN LINK FABRIC (VINYL CLAD)

A. Chain Link fence fabric shall be factory coated 6 gauge core wire (or 9 gauge in certain circumstances as indicated on the details) with a min .02 inch thick coating of plasticized polyvinyl-chloride applied by the fusion method over a thermoset plastic bonding agent. The bond shall exhibit equal or greater strength than the cohesive strength of the vinyl. All cut ends shall be coated with vinyl at the factory. Fabric shall be 1.75" mesh at tennis court installations and 2” mesh at all locations and black in color throughout.

B. Top and bottom of fabric shall have knuckled selvage, both sides.

2.03 FITTINGS AND ACCESSORIES (VINYL CLAD)

A. All accessories shall be vinyl clad in accordance with paragraph 2.01 above, and galvanized in conformance with ASTM Designation A153.

B. Post Caps

Furnish and install tight fitting pressed steel or malleable iron caps, designed as a weather tight closure cap. Provide one (1) pass-through looped cap for each line post, and one (1) acorn style cape for each end or corner post. Where top rail is used, provide looped cap tops to permit passage of top rail.

C. Tension Bars

1. One (1) piece lengths equal to full height of fabric with minimum cross section of 3/16" x 3/4", conforming to ASTM Designation A123. Provide one (1) stretcher bar for each end post and two (2) for each corner and pull post.

2. Tension bands and brace bands, if utilized, shall be 7/8" x 12 gauge beveled, galvanized, sized to fit pipe sizes and furnished with galvanized

fasteners. Galvanizing shall conform with ASTM Designations A123 or A153 as they pertain.

D. Rail Clamps

1. Rail clamps shall be standard clamps (boulevard clamps) furnished complete with fasteners with ASTM Designation A153.

E. Fabric Bands for Tying Fabric

1. Fabric shall be attached using a BAND-IT band and buckle system
2. Bands shall be 0.020" thickness, 200/300 series stainless steel ½" wide bands, with a minimum breaking strength of 850 lbs., ½" band capacity ear-loct design buckles to be manufactured with 0.050" thick material, 201/301 series stainless steel.

F. Fittings, lugs, clamps and other accessories shall be steel conforming to ASTM Designation F626 and galvanized in conformance with ASTM Designation A153.

2.04 ANCHORING CEMENT

A. Cement for anchoring posts in sleeves embedded in concrete walls shall be "POR-ROK", as manufactured by Hallemite (Lehn and Fink Industrial Products, Division of Sterling Drugs, Inc.), Montage, New Jersey, or approved equal.

B. "Sika Cola-Due" by the Sika Co.

C. "Five Star Grout" the Five Star Co.

2.05 CEMENT CONCRETE

A. Cement concrete for post footings shall conform to Section 03300 of these Specifications.

PART III - EXECUTION

3.01 POST INSTALLATION

A. Install new vinyl coated chain link fence in the location(s) shown on the Contract Drawings, and as approved by the Landscape Architect.

B. Excavation for post footings as herein before specified in Section 02300 of these Specifications, shall be in firm undisturbed or compacted soil. Post footing diameters vary according to post sizes required and are in accordance with attached details. Excavate hole depths six (6) inches lower than post bottom with bottom of posts set not less than thirty-six (36) inches below surface when in firm,

undisturbed soil. Where ledge is encountered, the Contractor shall notify the Landscape Architect to determine method of installation. Payment for any additional work required when installations are in ledge shall be in accordance with methods described in SPECIAL CONDITIONS of these Specifications.

C. Place concrete around posts in a continuous pour, tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operation. Crown the top of the concrete footings to pitch water away from posts.

D. Under bituminous pavements, tops of footings are to be finished smooth and are to pitch one (1) inch from the posts to the outside edge of the foundation.

E. In mower strip locations, form top twelve (12) inches square and finish to match mower strip with 1/4" pitch away from posts.

1. If applicable, top of fence footings at players' benches and cement concrete mower strips shall terminate six (6) inches below pavement finish grade.

3.02 FENCE ERECTION

A. Top and Bottom Rails

1. Top and bottom rails shall form a continuous brace from end to end of each fence run. In addition, all end and corner posts shall be braced to the nearest line post with center brace rails. Outside sleeve type top rail coupling shall be placed a maximum of twelve (12) inches from line posts.

B. Middle Rails

1. All chain link fencing ten (10) feet or more in height shall have a continuous middle rail.

C. Brace Assemblies

1. Furnish and install braces and appurtenances so posts are plumb when diagonal rod is under proper tension. All "tension" assemblies shall conform to ASTM 567 and the MASS DPW Standard Specifications Section M.8.09

D. Fabric

1. The fabric shall be installed on the "public" or "sports field" side of the fence.

2. All fabric shall be aligned so that the top row of the fabric mesh is tied to the top rail, and so that the bottom selvage of fabric mesh stands one (1) inches above the finish grade of the lawns, pavements or concrete wall grade and that the bottom row of the fabric mesh is tied to the bottom rail.

3. Fabric shall be properly stretched and securely fastened to the posts and rails, and between posts the top and bottom of the fabric shall be fastened to the horizontal braces as herein specified, and approved by the Landscape Architect. Fabric shall be stretched uniformly taut and as tight as possible, true to line and grade and complete in all details. Install tension bars at corners.

4. The fabric shall be fastened to end and corner posts with tension bars and stretcher bar bands spaced at one (1) foot intervals.

E. Stretcher Bars

1. Thread through fabric and secure to posts with approved metal bands spaced not over twelve (12) inches O.C.

F. Fabric Bands

1. Fabric Bands shall be placed at the intervals indicated on the details and securely fastened to all fence posts.
2. All bands shall be pulled tight an raw ends of steel bands shall be secured in buckle by folding ear tabs around steel bands as per manufacturer's recommended installation procedure. No sharp edges shall protrude from band-it buckles. Band will be PVC coated, color to match fabric and framework.

G. Fasteners

1. Install nuts for tension band and hardware bolts on side of fence opposite fabric side unless directed otherwise by the Landscape Architect.

3.03 GATE FRAMES (WHERE APPLICABLE)

A. Gate frames shall be galvanized steel 1.90" O.D. standard weight pipe, 2.72 pounds per linear foot. Gates shall be fabricated using welded construction with all welds ground smooth and coated with 3.0 mil. thickness of cold galvanizing compound. Gates must be properly braced to eliminate any possible sagging condition. For gates over eight (8) feet in height, provide additional horizontal and vertical interior members to ensure proper strength.

B. Fabric shall be installed with hookbolts and tension bars on all four (4) sides and attached to gate frame at twelve (12) inches on center.

C. Hardware materials shall be hot dipped galvanized steel. All moveable parts (e.g., hinges, latch, keeper, and drop bar) shall be field coated with PVC touch-up paint, provided by the manufacturer.

D. Hinges shall be of sufficient structural strength and design to support gate leaf and to permit easy and trouble free operation. Non-lift-off type hinge design shall permit the gate to swing 180 degrees inward or outward in accordance with the Contract Drawings

E. All gates shall be equipped with a positive type latching device capable of retaining the gate in a closed position and have provision for padlock. Latches shall permit operation from either side of gate and must be approved by the Landscape Architect prior to the installation. Refer to details for latch device.

F. Gate keepers shall be provided for each gate leaf over five (5) feet wide. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.

G. Double gates: Provide drop rod to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of the latch, requiring one padlock for locking both gate leaves.

H. Gate Installation

1. Check gate posts for vertical alignment and maintain in position during placement and finishing operations.

2. Set keeper, stops, sleeves into concrete.

3. Install gates plumb, level and secure for full opening without interference.

4. Attach hardware by means which will prevent unauthorized removal.

5. Adjust hardware for smooth operation.

3.03 FINISH PROTECTION

A. During the fence installation, care shall be taken to avoid damaging the vinyl clad or galvanized surfaces of the fence components. All scratches and abrasions shall be thoroughly corrected in a manner satisfactory to the Landscape Architect before final acceptance.

END OF SECTION

SECTION 02822

BALLFIELD BACKSTOP

PART I - GENERAL

1.01 SCOPE OF WORK

a. Under this Section the Contractor shall furnish all labor, materials, equipment and transportation required to furnish and install protective netting in compliance with the contract drawings and all requirements described herein.

b. In general, the protective netting is incorporated directly above the backstop on all sides.

1.02 REFERENCE STANDARDS AND SPECIFICATIONS

a. References herein to any technical society, organization, group or body are made in accordance with the following abbreviations:

1. ASTM American Society for Testing Materials

2. AWS American Welding Society

b. See the following sections for related work:

1. Section 02300 EARTHWORK
2. Section 02820 BVC CHAINLINK FENCING
3. Section 03300 CAST IN PLACE CONCRETE

1.03 QUALITY ASSURANCE

a. All fencing shall conform to the specifications of the Chain Link Fence Manufacturer’s Institute and as specified herein.

1.04 SHOP DRAWINGS

a. Shop drawings or manufacturer's specifications shall be submitted in accordance with the provisions of the Special Conditions Section of the Contract Specifications.

b. The Contractor shall submit complete manufacturer's shop drawings to the Owner’s Representative for approval. Such drawings shall show details for posts, rails, fabric, fittings, attaching hardware and all other necessary appurtenances.

c. No backstop fencing materials shall be procured by the Contractor until written approval is received from the Owner's Representative.

1.04 SAMPLES

a. Samples of all fence materials furnished under this Section shall be submitted for approval prior to the start of construction.

b. Samples of the cold galvanizing compound shall be submitted for approval in factory-sealed containers.

c. Submit the following samples in accordance with the provisions of the SPECIAL CONDITIONS.

1. Submit samples and descriptive literature of all items specified by the Engineer.

PART II - MATERIALS

2.01 POSTS, RAILS AND FRAMEWORK

a. All backstop pipe shall be black vinyl clad steel conforming to ASTM Designation A120, Schedule 40. All members shall be furnished in one-piece lengths for each section of backstop fencing.

b. Member sizes are as follows:

1. Posts shall be 4.00" O. D. pipe, weighing 9.11 lbs. per linear foot.

2. Rails for the backstop section shall be 1.66" O. D. pipe, weighing 2.27 lbs. per linear foot

3. Canopy frame shall be 1.90" O. D. pipe, weighing 2.72 lbs. per linear foot.

4. Truss rods shall be provided as required to support the structure and submitted via shop drawing from fence manufacturer for approval by Owner's Representative.

2.02 FENCE FABRIC

a. The fabric shall be woven black vinyl coated steel chain link conforming to ASTM Designation A491-63T in its entirety.

b. The fabric shall be supplied in the following sizes:

1. 6 gauge (0.192"), 1.5 inch mesh for general vertical uses

2. 9 gauge (0.148"), 1.5 inch mesh for canopy sections

c. All fabric shall be furnished with top and bottom selvage knuckled.

d. After fabrication, the fabric shall be thoroughly cleaned and given a clean organic coating by the complete immersion process. The coating shall be a minimum of 0.40 ounces per square foot of wire fabric with the weight of coating determined by the strip test specified in ASTM Designation A428-58T.

2.03 FENCE ACCESSORIES

a. Tension Bars and Bands

1. Tension bars shall be three-sixteenth (3/16) inch by three-quarter (3/4) inch galvanized steel conforming to ASTM Designation A123. 2.Tension bands shall be 7/8" x 12 gauge beveled, galvanized, sized to fit the backstop posts and framework and furnished with galvanized fasteners. Galvanizing shall conform to ASTM Designations A123 or A153 as they pertain.

3. Tension cables shall be 3/8" diameter galvanized 7-strand steel cable conforming to ASTM Designation A475, Common Grade. Accessories such as turnbuckles, thimbles, hooks, eyes and other fasteners shall be compatible for the required use per ASTM 567.

b. Fittings, Rail Clamps and Fabric Bands

1. Fittings, lugs, clamps and other accessories shall be steel conforming to ASTM Designation F626 and galvanized in conformance with ASTM Designation A153.

2. Rail clamps shall be standard clamps (boulevard clamps) furnished complete with fasteners, all conforming to the same requirements as for fittings above.

3. Fabric shall be attached using A-58 self-locking fabric bands as manufactured by Band-It Ties, or an approved equal.

c. Post Caps

1. Furnish and install tight fitting pressed steel or malleable iron caps, designed as a weather tight closure cap. Provide one (1) pass-through

looped cap for each line post, and one (1) acorn style cape for each end or corner post. Where top rail is used, provide looped cap tops to permit passage of top rail.

2.04 COLD GALVANIZING COMPOUND

a. Cold galvanizing compound shall be a single component zinc rich compound yielding a dry film of at least eighty-five percent (85%) pure zinc. Galvanizing compound shall meet or exceed the requirements of Federal Specifications MIL-P-21035, TT-P-641d primer for zinc rich compounds.

2.05 CEMENT CONCRETE

a. Cement concrete for post footings shall conform to Section 03300 of these Specifications.

2.06 EXCAVATION AND BACKFILL

b. Excavation and backfill for post footings shall conform to Section 02350 of these Specifications.

PART III – EXECUTION

3.01 LAYOUT

a. The Contractor shall layout the backstop and place wood stakes as required at post locations and then notify the Owner's Representative that the unit has been laid out. It shall be the Contractor's responsibility to offset the stakes installed by his Engineer and take extreme care not to disturb these stakes before incorporating them into his work. Layout shall include setting of wood stakes at 1st, 2nd, and 3rd base and home plate.

3.02 POSTS

a. The Contractor shall excavate for proposed reinforced foundations and post footings and shall inspect the excavation to ensure that surrounding areas of footing are stable and holding vertically.

b. Pour footings against undisturbed subsoil and onto compacted bottom of void. Set posts plumb and to the proper heights for assembly and place foundations.

c. Allow footings to cure sufficiently prior to assembly of backstops, and brace and stay all posts sufficiently until curing is adequate.

d. Under bituminous pavements, pitch tops of foundations one (1) inch away from posts.

e. Backfill and compact in no greater than eight (8) inch layers around foundations.

3.03 POSTS AND RAILS

a. All framework, rails, posts, shall be joined as detailed on the drawings, as specified under Section 7.01 of these Specifications, and as modified herein.

b. Rails at the front of canopy shall be fastened to the framework with fittings and ornamental post caps. At end and corner posts, the Contractor shall install three-quarter (3/4) inch by three sixteenth (3/16) inch galvanized steel tension bars to hold wire to tension bands or ties.

c. At all end, corner and line posts, the Contractor shall furnish and install 1/4" galvanized steel lugs welded to the pipe frame, as shown on the plans. These steel lugs shall be attached to receive collar ends bolted onto braces, struts, and rails and shall be bolted to the framework as indicated on the plans. All bolt ends shall be peened or prick-punched after tightening.

d. At existing backstops, after existing fabric has been removed, install another intermediate rail in the bottom panel. Tie at twelve (12) inches on center typically.

3.04 WELDING

a. Hood framing shall be strongly welded at all joints shown on the plans. Struts shall be welded to post and hood frame.

b. After the welding has been completed, the surfaces of all welds shall be thoroughly cleaned, wire brushed and coated with two (2) coats of liquid galvanize.

3.05 WIRE TENSION CABLES

a. The backstops shall be properly stayed horizontally, as shown on plan, with three-eighths (3/8) inch galvanized steel wire tension cables complete with necessary galvanized turnbuckles, hooks, eyes, bolts, etc. Cable to be fastened around galvanized malleable iron thimbles and wire rope clamps.

3.06 FABRIC

a. All fabric shall be installed by means of standard chain link stretching equipment.

The finished backstop shall be plumb, taut, true to line and grade and complete in every detail.

b. The fabric shall be fastened to all intermediate posts, all rails, and backstop framework with Band-It Ties, spaced every twelve (12) inches, with ties bent inward to prevent injury.

c. Tops and bottoms of fabric shall have knuckled selvages; and no twisted, knurled, exposed or cut metal wire fabric ends shall be permitted. Fabric sections shall be jointed as directed by the Owner's Representative, so that no selvages protrude out towards the playing field.

END OF SECTION

SECTION 02886

PLAY EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and transportation required furnish and install/assemble the play equipment as located, described and set forth in the contract plans, specifications and details and in accordance with manufacturer's requirements and recommendations, and as specified herein.

1.02 REFERENCE STANDARDS AND SPECIFICATIONS

A. Playground equipment design, layout, and installation shall comply with the following standards and guidelines as applicable.

1. CPSC - Consumer Product Safety Commission Guidelines for Playground Safety, latest edition.

2. ASTM - American Society for Testing and Materials, Designation: F 1487, Standard Consumer Safety Performance Specification for Playground Equipment for Public Use, latest edition and related sections.

3. ANSI - American National Standards Institute.

4. AASHTO - American Association of State Highway and Transportation Officials (tests of specifications).

5. MassDOT. - Latest edition of the Standard Specifications for Highways, Bridges and Waterways,

6. MAAB - Massachusetts Architectural Access Board

B. Requirements not specifically set forth herein, but required by the agencies listed in above shall be understood to be a requirement of this contract since these standards of quality and safety are established as the industry standard(s). Any conflicts between the agency standards and the contract documents shall be brought to the attention of the Engineer, and unless otherwise directed in writing, the agency standards shall be the minimum requirement to be followed.

1.03 SHOP DRAWINGS

A. Prior to disassembling the play equipment as required by the Contract Documents, the following shall be submitted to the Project Representative for review and approval:

1. Shop drawings showing all important details of construction and dimensions showing the equipment, arrangement, footing spacing and lengths. Shop drawings shall stipulate and certify to compliance with all CPSC and ASTM standards and guidelines as applicable. Colors shall be selected by the Engineer and indicated on the shop drawings

1.04 QUALIFICATIONS

A. Installer shall have a minimum of five (5) years experience with a minimum of fifteen (15) playground installations. References will be required. General Contractor shall have direct experience with playground related projects including at least 10,000 s.f. and 50 pieces of play equipment within the last three (3) years.

PART 2 - MATERIALS

2.01 PLAY EQUIPMENT

A. The play equipment for this park is as follows:

1. 2-5 Play Structure
   a. Playshaper play structure or approved equal.

2. 5-12 Play Structure
   a. PlayBooster Hybrid play structure or approved equal.

3. Swings
   a. Arch Swings with anti-wrap swing hangers, steel reinforced EPDM rubber swing, Accessible Swing Seat, 2 molded bucket seats and TenderTuff or ProGuard –finished chain or approved equal.

4. Cozy Dome play structure or approved equal.

B. The play structures shall also comply with the technical specifications included within this Specification section.

C. Contractor shall installed Playground Regulations sign as provided by approved

playground manufacturer. Text will be provided by Owner's representative and approved by Owner.

D. Prior to Project Closeout, Contractor shall install safety and regulatory labels on each play equipment as provided and directed by CPSI playground manufacturers.

2.02 CAST IN PLACE CONCRETE

A. Concrete for the footings will be cast in place cement concrete as specified in Section 03300 of the Specifications. Top of concrete footings shall be twelve (12) inches minimum below finished grade and shall have a pitch outwards from the post.

2.03 MAINTENANCE KIT

A. The Contractor shall provide the Owner with a maintenance kit that is to include twenty (20) replacement hardware covers / caps for each play structure, one (1) gallon of graffiti removal / cleaning solutions as recommended by the manufacturer, a manual that includes all installation and maintenance instruction provided by the manufacturer.

B. The Contractor shall provide 10 spare pieces of each type of hardware / fastener used on the structure and the appropriate tools delivered to the Owner's Maintenance Yard.

PART 3 - EXECUTION

3.01 The Contractor shall assemble the specified equipment under the supervision of an approved Supervisor according to the manufacturer's instructions, the contract drawings and these Specifications.

3.02 The Contractor shall locate the structures to the lines and grades specified in the drawings in these Specifications and according to the specifications of the manufacturer of the equipment. Adjust all equipment to suit site gradients; no sloping platforms, tracks, or members intended to be horizontal shall be accepted.

3.03 The excavation for the footings shall be done as specified in Section 02300 of these Specifications and according to the Contract Drawing details.

3.04 The equipment shall be located and brought to the heights as shown in the drawings and as recommended by the manufacturer with vertical and horizontal members set plumb and then braced to be held in place.

3.05 The concrete footings shall be poured around the supporting pieces of the equipment to the elevations specified by each manufacturer. Footings shall be at least 6" BELOW the finished grade of safety surfacing under rubber and 12" below safety surfacing under fiber mulch. The concrete shall be poured and cured according to Section 03300 of these Specifications. Slope tops of footings to drain; set bottom of vertical members into gravel base to ensure drainage; do not encase bottom in concrete.

3.06 After the specified cure period of the concrete has passed the bracing may be removed.

3.07 The fills and surfaces shall then be placed and brought to the grades shown in the Contract Drawings and in accordance with Section 02350 of these Specifications.

3.08 The contractor shall refer to Appendix A of these specifications for additional information on the play equipment.

PART 4 - GUARANTEE AND ACCEPTANCE/LIABILITY

4.01 All operating parts and structural elements of the play equipment and safety surface shall be guaranteed against failure or defect during normal use and operation for the entire warrantee period as established by the manufacturer.

4.02 Any defective elements shall be replaced in part or whole by the Contractor at no cost to the Owner.

4.03 The Contractor and the manufacturer shall hold the Owner and Engineer harmless from any and all damages or liability resulting from negligent acts and omissions on the part of the Contractor or manufacturer, or resulting from defective parts, or improperly assembled equipment. Contractor shall provide secure storage for all equipment on job site.

4.04 The Contractor is responsible for securing a Certified Playground Safety Inspector to ensure ASTM and CPSC compliance. A certificate of compliance will be issued to the Owner prior to final inspection.

END OF SECTION

SECTION 02887

RUBBER SAFETY SURFACING

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. The Contractor shall furnish all labor, materials, equipment and transportation required for the placement of poured-in-place play surfacing at children's play area. The surfacing shall be placed at all locations identified on the Contract Drawings to the indicated grades. Layout and design of color and pattern is to be installed per the contract drawings.

1.02 SUBMITTALS:

A. In accordance with the SUBMITTAL section of these specifications submit manufacturer's specification and detail sheets for all materials to be utilized under this section.

B. Field layout of color and pattern of surfacing to be approved by Landscape Architect prior to installation.

C. Provide samples as directed by the Engineer.

D. Post installation testing will be required by the Owner at the Contractors expense. An independent testing agency shall test to ensure a HIC of 800, contractor is responsible for removal and reinstallation if the test results do not conform.

1.03 QUALIFICATIONS:

a. For installation of the poured-in-place play surface the contractor shall have a minimum of five (5) years experience provide evidence of successful completion of twenty-five (25) like surfaces installed during the past five (5) years with names of clients and phone numbers.

PART 2 - MATERIALS

2.01 POURED-IN-PLACE-PLAY SURFACE

A. Poured-in-place play surface shall be "Playbound" by Surface America, GT-Max Poured by Gametime Inc. or products supplied by VitriTurf of Bohemia, NY 631.231.1300 or approved equal.

Play surfacing shall meet or exceed current Consumer Product Safety Commission (CPSC) guidelines issued in 'A Handbook for Public Playground Safety' (latest edition) for the minimum potential fall height of the play equipment, current Disabilities Act Guidelines (ADA) and current American Society for Testing Materials (ASTM) F-1292-91 requirements.

1. The Base Mat shall be a monolithic poured-in-place cushioned pad, made from a blend of recycled styrene butyrene rubber (SBR) and a polyurethane binder or approved equal. The depth of the SBR mat shall be such that in conjunction with the specified top-wearing course the total resilient surface system shall provide the required absorbency for the maximum potential fall from the specified play equipment. (Refer to Section 02886) SBR shall be mixed with the binder in a ratio of 88% SBR to 12% binder by weight to achieve maximum resilience.

2. The Top Surface shall be a monolithic poured-in-place top surface, ½" total thickness, made from a blend of ethylene propylene diene monomer (EPDM) colored rubber particles there will be up to FOUR separate colors and each shall include a custom combination of four colors with NO BLACK to be chosen by the owner's representative during the submittal process combinations indicated in manufacturer's brochures. Top surface shall have a tensile strength of two hundred (200) psi. The urethane binder shall be an aliphatic non-yellowing type.

3. Poured-in-place surfacing shall be placed throughout the full extent of the two playlots. The total depth of poured-in-place surfacing shall sufficient to meet a HIC of 800 at installation based on maximum fall height of play structure indicate on the plans and specifications.

4. Prefabricated shock pads will not be considered equal.

2.04 BASE MATERIALS

A. Crushed stone materials shall be as specified under Section 02350 of these Specifications, or as otherwise indicated on the details.

PART 3 - EXECUTION

3.01 PROCEDURES

A. The Contractor shall deliver, spread and compact or place safety surfaces to conform to the lines and grades shown on the Contract Drawings. All work shall be done in accordance with the manufacturer's installation recommendations for wood mulch or Poured-in-Place Play Surfaces.

B. The Base Mat for the Poured-in-Place Play Surface shall be installed in accordance with the manufacturer's instructions. The Base Mat shall exhibit a minimum installed thickness necessary to provide the required absorbency for the maximum potential fall from the proposed play equipment. At playlot edges, place a board between the end of the poured-in-place base pour and the concrete edge and remove the board after the base has sufficiently cured. Pour the top course of poured-in-place surfacing and allow material to fill the void created by the board.

C. The Top Surface shall be installed following installation of the cushion course, in accordance with the manufacturer's instructions. The minimum installed thickness of the top wearing course shall be ½". The contractor is responsible for insuring that no foot traffic is allowed on the surface before the curing is complete.

D. Any tests of materials, and/or compaction shall be as ordered by the Engineer, and paid for by the Contractor regardless of results.

E. WARRANTY: Safety surfacing shall be free of defects due to workmanship or material for a minimum of two (2) years from date of installation.

END OF SECTION

SECTION 02910

SCREENED LOAM BORROW AND TOPSOIL RE-USED

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Under this Section, the Contractor shall furnish all labor, materials, equipment and transportation required to furnish and place ½" Screened Loam Borrow as shown on the drawings and as specified. Where proposed tree and shrub planting mix and/or sod or seed is noted on the drawings, it shall be composed of Loam Borrow, or Topsoil Reused in compliance with this specification.

B. Prospective bidders are advised that significant quantities of topsoil are present at the property and presumably available for reuse if compatible with the requirements of this specification. The Contractor shall be responsible for amending topsoil, as required to comply with this specification.

1.02 SAMPLES/TESTS:

A. The Contractor shall furnish a Certified Laboratory Report showing the soils classification and nutrient analysis of representative samples of the proposed Loam to be used, including the extent of lime and fertilizer required. Samples submitted for approval must be representative of the total volume to be furnished, taken in the presence of the Engineer, and delivered to a certified laboratory by the Contractor; all costs for such shall be borne by the Contractor.

B. At least ten (10) days prior to shipment/delivery of materials, the Contractor shall submit to the Owner a one (1) cubic foot representative sample, certifications, certified test results for materials as specified below. The Contractor shall provide a listing of the addresses (locations) identifying the origin of the soil to be delivered. If the origin is from multiple locations, all locations shall be provided at the time of submission of required information specified above. No materials shall be ordered or delivered until the required submittals have been reviewed and approved by the Owner. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Owner shall reserve the right to reject, on or after delivery, any material that does not meet these Specifications.

C. If the material does not conform to the above requirements it shall be rejected and additional sources shall be found. Sampling and testing shall be accomplished as specified herein until an approved material is found, all at the Contractor's expense.

D. To assure that materials fulfill specified requirements regarding textural analysis, organic matter content, pH, and fertility testing may be undertaken:

1. Prior to site delivery; at source;

2. At time of delivery; on-site; and/or

3. Immediately following spreading on site. Soil sampling shall also indicate if specified soil was supplied uniformly to the minimum specified depth.

1.03 STANDARDS:

A. ASTM - American Society for Testing and Materials.

1.04 NOTIFICATION:

A. The Contractor shall notify the Owner in writing at least ten (10) days in advance of the time he intends furnishing Screened Loam Borrow stating the location and amount of such deposit, the name and address of the supplier and also shall furnish such facilities, transportation and assistance as the Owner may require for collecting and forwarding samples.

PART 2 - MATERIALS

2.01 LOAM BORROW:

A. In accordance with the specific requirements of this project, existing on-site soil may be re-used as Loam Borrow only if it meets this Specification. Existing topsoil that does not meet this Specification may be re-used only up to the subgrade elevation within the limits of areas to receive new Loam Borrow. The Contractor shall furnish all required Loam Borrow, from off site sources, as necessary, to complete the project.

B. Screened Loam shall be "fine sandy loam" or "sandy loam" determined by mechanical analysis (ASTM D-422) and based on the "USDA" Classification System". Screened Loam has the following mechanical analysis:

Textural Class	Percentage of Total Weight	Average Percentage
Sand (0.05 – 2.0mm)	45 – 75	60
Silt (0.002 – 0.05mm)	15 – 35	25
Clay (Less than 0.002mm)	5 – 20	15

C. Screened Loam shall be a natural product consisting primarily of natural topsoil, free from subsoil, and obtained from an area that has never been stripped, as noted above, the location of the source of the loam must be submitted to the Owner.

Screened Loam shall not contain less than five percent (5%) nor more than ten percent (10%) organic matter as determined by the loss on ignition of oven-dried samples, at 100°C ± 5°C. To adjust organic matter content, the soil may be amended, prior to site delivery, by the addition of composted leaf mold or peat moss. Use of organic amendments is accepted only if random soil sampling indicates a through incorporation of these materials. No mixing or amending of Loam will be permitted on site. The Loam shall not be delivered when in a wet or frozen condition.

D. Screened Loam shall consist of fertile, friable, natural loam capable of sustaining vigorous plant growth. Loam shall be without admixture of subsoil, and refuse, resulting in a homogeneous material free of stones greater than ½" in the longest dimension, be free of lumps, plants, glass, roots, sticks, excessive stone content, debris, and extraneous matter as determined by the Owner. Screened Loam shall be within the pH range of 6.0 to 6.5 except as where noted on plans and details. It shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. The maximum soluble salt index shall be 100. Screened Loam shall not have levels of aluminum great than 200 parts per million.

E. If limestone is required to amend the screened loam to bring it within a pH range of 6.0 to 6.5 no more than 200 pounds of limestone per 1,000 square feet of loam, incorporated into the soil, or 50 pounds of limestone per 1,000 square feet of loam, surface application, within a single season.

F. The Owner will reject any material delivered to the site that does not meet these Specifications after post-delivery testing. If the delivered screened loam does not meet the specifications stated in this document, the delivered screened loam will be removed by the Contractor at the Contractor's expense and at the time of rejection.

G. The topsoil shall not be handled or moved when in a wet or frozen condition.

H. Topsoil structure shall not be destroyed through excessive and unnecessary handling or compaction. Inappropriate handling leading to the compaction or deterioration of soil structure will result in rejection of topsoil for use.

I. At no time should equipment or material rest on the soil.

J. Loam Borrow shall be free of plants and their roots, debris and other extraneous matter. It shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. The electrical conductivity (EC2) of a 1:2 soil-water suspension shall be equal to, or less than, 1.0 millimhos/cm. (test material passing #4 sieve).

2.02 REUSE OF EXISTING TOPSOIL:

A. The reuse of topsoil that does not meet the specifications for use as loam borrow

may only be permitted for use as a general fill material to subgrade elevations at the limits of lawn and planting areas.

B. Care shall be taken not to overwork the soil, causing it to break down, utilizing only agricultural equipment such as plows, discs, or harrows and portable quarry sieves, screens, or blenders.

PART 3 - EXECUTION

3.01 PLACEMENT:

A. The Contractor shall furnish and spread Loam Borrow to the depths shown on the contract drawings, which depth shall be the minimum required depth after settlement. No compaction shall be required beyond that extent necessary to place sod or to plant trees and shrubs to ensure against unevenness or settling below accepted growth lines.

3.02 ADDITIVES:

A. The Contractor shall apply all necessary fertilizer and lime to the soil in accordance with the manufacturer and laboratory's recommendations and as required by the sodding, seeding and/or planting specifications referenced elsewhere.

END OF SECTION

SECTION 02911

ROOT ZONE MIX PREPARATION & BLECAVATION

PART I - GENERAL

1.01 SCOPE OF WORK:

A. Under this Section, the Contractor shall furnish all labor, materials, equipment (including low ground pressure, LGP, equipment) and transportation required to furnish and place, or prepare Root Zone Mix for the field and to perform 'blecavation' operations for the areas shown on the drawings and as specified as "full depth renovation". Refer to Appendix E for acceptable equipment.

B. Prospective bidders are advised that significant quantities of topsoil are present at the property and presumably available for reuse if compatible with the requirements of this specification. The Contractor shall be responsible for amending topsoil, as required to comply with this specification and SECTION 02910 SCREENED LOAM BORROW AND TOPSOIL RE-USED.

C. This work shall consist of preparing a root zone mixture consisting of screened native on site loam, sand and compost and performing blecavation as described in item 'd' below. The root zone mix will be evaluated by using the ASTM test methods for High Performance Sand-based Root Zones for Sports Fields, ASTM F 2396-04 as shown in Appendix E. A sand sample and compost sample shall be submitted to a testing agent for adherence to specifications. Through the blecavation process that uses the blecavator machine set to varying height controls, the compost and sand can be blended with top soil on-site to a desired depth ranging from 6-8" at the construction site.

D. The Contractor shall perform blecavation operations within the areas delineated on the plans. The Contractor shall prepare the soil using the blecavator, which is a heavy duty contra-rotating rotor with blades that dig into the ground throwing soil, debris, and rocks against a sorting screen mounted behind the rotor for separating rocks and debris. The fine soil is deposited over the top and leveled off. The rear packer roll on the blecavator firms up the finished areas ready for seeding. Within the area delineated on plans, the contractor shall be directed by the owner or owner's representative, to perform blecavation for varying depths ranging from 8" to 12" to adjust to varying depths of existing topsoil, in order to achieve a homogeneous blend of top soil composition over the entire field within the limits of the full depth renovation areas.

E. The Contractor shall have the option, at their discretion, to remove all existing turf and loam from the fields and either mix on site or bring in Root Zone Mix that adheres to this specification. The blecavation technique, however, seems to be the

most efficient process.

F. The Contractor shall have the option, at their discretion to either remove the existing turf layer prior to re-grading or to re-grade and blecavate the designated area.

G. No heavy duty equipment and vehicular traffic shall be allowed on the prepared areas. While using the blecavator, the contractor shall fine grade soil over the blecavation areas based on the proposed elevations indicated on the site plan.

1.02 SAMPLES/TESTS:

A. The Contractor shall furnish an outline of their approach to the project no less than ten (5) days prior to the start of construction.

B. The Contractor shall furnish a Certified Laboratory Report showing the soils classification and nutrient analysis of representative samples of the Loam that is proposed to be used, including the extent of lime and fertilizer required. Samples submitted for approval must be representative of the total volume to be furnished, taken in the presence of the Engineer, and delivered to a certified laboratory by the Contractor; all costs for such shall be borne by the Contractor.

C. If the material does not conform to the above requirements it shall be rejected and additional sources shall be found. Sampling and testing shall be accomplished as specified herein until an approved material is found, all at the Contractor's expense.

D. To assure that materials fulfill specified requirements regarding textural analysis, organic matter content, pH, and fertility testing may be undertaken:

1. Prior to site delivery; at source;

2. At time of delivery; on-site; and/or

3. Immediately following spreading on site. Soil sampling shall also indicate if specified soil was supplied <u>uniformly</u> to the minimum specified depth.

1.03 RELATED WORK:

A. Section 02910, SCREENED LOAM BORROW AND TOPSOIL RE-USED

B. Section 02290 SEEDING

C. Section 02810, IRRIGATION

D. Section 02920, SODDING

1.04 STANDARDS:

A. ASTM - American Society for Testing and Materials.

1.05 NOTIFICATION:

A. The Contractor shall notify the Owner in writing at least ten (10) days in advance of the time he intends furnishing Root Zone Mix or amendments stating the location and amount of such deposit, the name and address of the supplier and also shall furnish such facilities, transportation and assistance as the Owner may require for collecting and forwarding samples.

1.06 QUALITY CONTROL:

A. Root zone mix: A one gallon sample for every 2,000 cubic yards of root zone mix shall be tested by the Owner's Testing Agent for approval.

B. Following installation of irrigation system and prior to installation of sod, contractor shall notify landscape architect or owner and provide the owner with compaction tests along the center line of the field as well as along the side lines to ensure that the root zone mix has not been heavily compacted. Compaction test shall fall within the industry standards for fields and any areas of the field that exceed these standards shall be corrected at the contractor's expense prior to installation of sod.

C. The Contractor or Sub-contractor must have a minimum of five (5) years of experience installing root zone mix based athletic fields of similar size and quality of this project.

PART II - MATERIALS

2.01 LOAM BORROW:

A. Refer to Section 02910, SCREENED LOAM BORROW & TOPSOIL RE-USED.

2.02 SAND:

A. Sand for Root Zone Mix shall conform to ASTM standard F 2396-04 Sand for High Performance Sand-based root zones for Sports Fields or 2mm USGA specification sand for golf coarse fairway top dressing. Refer to Appendix E.

2.03 PEAT OR ORGANIC MATERIAL:

A. Peat moss shall be of a standard brand free of sticks, stones, hay or any other deleterious Matt and meet the following requirements:

Parameter	Specification
Total Ash	15% or less
PH	6.5 to 7.5
% Moisture	30% to 50%
Sieve Criteria	
2.0 mm sieve	0-5% retained
1.0 mm sieve	Less than 20% retained

B. Compost - Compost shall be derived from organic wastes including sawdust, clean ground wood and biosolids that meet all State Environmental Agency requirements. The product shall be well composted, free of viable weed seeds and contain material of a generally humus nature capable of sustaining growth of vegetation, with no materials toxic to plant growth.

Compost shall have the following properties:

Parameters	Range
pH	6.5 – 7.5
Moisture content	35% - 55%
Soluble Salts	< 4.0 mmhos (dS)
C:N ratio	15 - 30:1
Particle Size	< 1/2”
Organic Matter Content	> 40%
Bulk Density	< 1000 lbs./cubic yard
Foreign Matter	< 1% (dry weight)

Compost generator shall also provide minimum available nitrogen and other macro and micro nutrients to determine fertilizer requirements. Generator shall supply documentation showing state approval for intended use.

C. Fertilizer - Renovate Plus, 3-3-3. Refer to Appendix E.

2.04 ROOT ZONE MIX:

A. Mixing Materials: Mixing of the sand, peat and soil mixture for the root zone mix must be blended by an experienced blending operator.

B. Physical performance Evaluation of the root zone mix will be in accordance with the guidelines set forth in ASTM standard F 2396-04.

PART III EXECUTION

3.01 ROOT ZONE MIX RATIOS:

A. Upon approval of the processed loam, sand and compost components, the owners testing agents shall blend the components to determine the correct ratio of sand and compost to create the root zone mix. This ratio of sand and compost will be based on laboratory testing and performance guidelines established by these specifications.

Based on previous testing and for bidding purposes, the mix ratio will contain approximately 65 to 70% Native Screened Loam, 25 to 30% sand and 5 % compost by volume.

B. The root zone mix developed by the owners testing agent will establish the required mix ratio and specifications for approval or rejections of all quality control submittals during construction.

Performance Testing: ASTM testing procedures for sand based athletic fields shall be used for performance testing.

3.02 PLACEMENT:

Root zone Mix Established by the Blecavation method:

A. The Contractor shall furnish and spread 2" thick 90/10 blend ASTM spec sand and ASTM F2396-04 spec compost amendments, distributed by a top-dresser for uniformity.

B. All sport turf areas are to be tilled to a depth of 8" – 10" with a blecavator, conventional tilling is unacceptable. This depth includes the 2" of ASTM spec sand as indicated above.

C. Fine grading shall be accomplished with a fully automated dual plain LGP laser grader.

D. Under no circumstances will loaded rubber tired vehicles in excess of 1 ton be allowed on the gravel base or root zone mix prior to, during or after the spreading of the root zone mix.

E. Finish grades shall be verified by the Contractor using laser operation survey instruments with a tolerance of +/- ¼ inch.

New or Blended Root zone Mix:

F. The Contractor shall furnish and spread Root Zone Mix to the depths shown on the

contract drawings, which depth shall be the minimum required depth after settlement. No compaction shall be required beyond that extent necessary to place sod or for the establishment of seed.

G. Root Zone Mix shall be spread in such a manner as to establish a loose, friable seedbed.

H. Under no circumstances will loaded rubber tired vehicles in excess of 1 ton be allowed on the gravel base prior to or during the spreading of the root zone mix.

I. Finish grades shall be verified by the Contractor using laser operation survey instruments with a tolerance of +/- ¼ inch.

3.02 ADDITIVES:

A. The Contractor shall apply all necessary fertilizer and lime to the soil in accordance with the manufacturer's and laboratory's recommendations and as required by the sodding, seeding specifications referenced elsewhere.

END OF SECTION

SECTION 02920

SODDING

PART I - GENERAL

1.01 SCOPE OF WORK

A. The work under this section shall require that the Contractor provide all labor, materials, equipment and transportation involved in the installation and establishment of a sodded lawn. The work shall include, but not be limited to, the respreading of root zone mix and furnishing of loam borrow, incorporating soil additives, fine grading, sodding and the protection and maintenance of the established lawn until final acceptance of the project, or a minimum of sixty (60) days, whichever is longer.

B. Contractor shall coordinate SODDING efforts with requirements for High Performance Root Zone Mix system and related sections. SODDING and related sections must be in accordance with ASTM F-2396 – 04 Standard Guide for Construction of High Performance Sand-Based Rootzones for Sports Fields.

1.02 SAMPLES

A. Submit the following samples in accordance with the provisions of the GENERAL CONDITIONS:

1. Suitable reusable topsoil or Loam Borrow as directed by the Engineer.

2. Sod with statement of composition percentages of purity and germination of each variety.

1.03 STANDARDS

A. Soil analysis in accordance with the current "Standards of the Association of Official Agricultural Chemists".

1.04 QUALIFICATIONS

A. Fine grading and installation of sod shall be done under the supervision of a qualified foreman acceptable to the Engineer.

1.05 SUBMITTALS

A. Provide affidavits from manufacturers and/or suppliers where required by these Specifications.

B. Provide watering and fertilizing schedule to Engineer for approval.

C. Provide two marked up prints to the Engineer indicating square footages for all lawn areas with quantities of all soil additives and sod for each area prior to beginning work.

D. Provide soil samples of the soil that the sod is grown in.

E. Provide all soil additives and fertilizers and indicated in Appendix E – Sand and Soil Amendments

1.06 GUARANTEE

A. Guarantee lawns until 1 Year after final acceptance of the project.

PART II-MATERIALS

2.01 GROWTH MEDIUM

A. Growth medium for all sod shall be consistent and compatible with the Root Zone Mix Preparation & Blecavation as described in Section 02911. In conjunction with the submittal process, a representative sample of sod growing medium shall be submitted for review, analysis and approval by the Engineer.

2.02 FERTILIZER

A. Fertilizer shall be 5-4-5, SILICAL, 0-0-20, 13-25-12 and indicated in Appendix E or approved equal.

2.03 LIMESTONE

A. Ground Limestone shall contain not less than eighty-five percent (85%) total carbonates and shall be ground to such fineness that fifty percent (50%) will pass through a 100-mesh sieve and ninety percent (90%) will pass through a 20-mesh sieve. Coarser material will be accepted provided the specified rates of application are increased proportionately on the basis of quantities passing the 100-mesh sieve.

B. After the loam has been spread and graded, and if recommended as a result of the soil analysis, apply ground limestone at the rate recommended by the testing laboratory. Assume at least twenty (20) pounds per one thousand (1,000) square feet.

2.04 SOD

A. After the preparation of the areas to be sodded has been approved by the Engineer, the Contractor shall sod the areas as specified herein. The Contractor shall sod with nursery-grown 100% Kentucky Bluegrass sod, as supplied by Tuckahoe Turf, Hammonton, NY, or approved equal. The composition of Bluegrass is as follows:

P105 Kentucky Bluegrass	30%
Midnight Star Kentucky Bluegrass	20%
Bewitched Kentucky Bluegrass	30%
Moonlight SLt Kentucky Bluegrass	20%

Sod shall be machine cut at a uniform soil thickness of on quarter inch (1/4") +/- one eighth (1/8"). Measurement for thickness shall exclude top growth and thatch. Sod will be big rolls 62.5' x 4' wide, no split rolls.

The sod shall be grown on a sandy loam type soil of similar type as the root zone mix specified. Sod with a high organic soil will not be allowed. The farm to be approved by owners testing agent.

The Engineer reserves the right to inspect each roll at the time of delivery. The sod will have a root development that will support its own weight without tearing.

Sod shall be uniform in color, density and thickness.

Sod shall be free of quackgrass, annual bluegrass, bindweed, Canada Thistle, wild onion, Muhlenbergia, bentgrass, Bermuda grass, clover, common broadleaf weeks and plants of varieties than those specified.

The sod producer and installer shall have a minimum of five years experience.

B. Submit blend percentages and names to Engineer for approval. The sod shall be grown by a recognized turf farm which meets the approval of the Engineer. The approved farm must, in turn, certify in writing that they are the Contractor's selected supplier.

C. Sod shall be furnished in either of the following dimensions:

1. **Required for large areas of ballfields:** Full "big Roll sod. Provided in rectangular sod strips termed consisting of overall dimensions of forty-eight (48) inches wide by a maximum of sixty-three (63) feet long. Stored on specially fabricated heavy duty tubes furnished by the sod supplier.

2. In rectangular sod strips measuring twelve (12) inches or sixteen (16) inches in width and from four (4) feet or six (6) feet in length, stored in rolls with the grass top side inverted so that the topsoil side is to the exterior. **Note: These smaller strips will only be acceptable for filling in smaller areas if needed.**

D. All sod furnished shall be living sod containing at least seventy percent (70%) of thickly matted grasses as specified, and free from noxious weeds.

E. Any sod with growth of more than two (2) inches in height shall be mowed to a height of from one and one-half (1 ½) to two (2) inches not more than five (5) days prior to harvesting. The sod shall be machine cut at a uniform soil thickness of from one-half (1/2) to three-quarter (3/4) inches, excluding top growth and thatch at time of cutting. The maximum allowable deviation from the widths and lengths specified shall be five percent (5%). No broken pads or torn and uneven ends shall be accepted. Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically with a firm grasp on the upper eighteen percent (18%) of the section. Sod shall not be harvested when its moisture content (excessively wet or dry) may adversely affect its survival.

F. Sod shall be harvested, delivered and installed within a period of thirty-six (36) hours. Sod not installed within this time period shall be inspected by the Engineer and shall not be installed prior to his approval. Any sod not approved by the Engineer shall be removed from the site by the Contractor and a fresh sod supply shall be furnished at no extra cost to the Owner.

PART III-EXECUTION

3.01 SOD BASE PREPARATION

A. Personnel for lawn work shall be familiar with sodding and lawn construction and be under the constant supervision of a qualified foreman.

B. After acceptance of sub-base as prepared under Section 02910 and 02911 of these Specifications, the Contractor shall do whatever additional grading is necessary to bring the sub-base to a true smooth slope, parallel and six (6) inches below finished grade for all areas to be sodded.

C. The top four (4) inches of the sub-base immediately prior to being covered with topsoil shall be raked or otherwise loosened and shall be free from stones, rock, and other foreign material three (3) inches or greater in dimensions.

D. There shall be sufficient grade stakes as determined by the Engineer to insure correct line and grade of sub-base and of finished grade.

E. Sub-base shall be inspected and approved by the Engineer before placing of topsoil.

F. Topsoil shall be placed and spread over approved areas to a depth sufficiently greater than necessary for the required thickness so that after natural settlement and light rolling, the completed work will conform to the lines, grades and elevations indicated. Supply additional loam, after testing and approval as may be needed to give the specified depths and finished grades under the contract without additional cost to the Owner.

G. After topsoil has been spread, it shall be carefully prepared by scarifying or harrowing and hand raking. All large still clods, lumps, brush, roots, stumps, litter and other foreign matter, and stones over one (1) inch in diameter shall be removed from the topsoil and also be free of smaller stones in excessive quantities as determined by the Engineer.

3.02 LIMING

A. The liming, fertilizing and sodding shall be done during a period of time to be approved by the Owner. In general sodding will be allowed after September 1 or before May 15. The Contractor shall notify the Owner thirty (30) days prior to the time that he intends to begin this work. No sodding shall be permitted prior to approval in writing by the Owner.

B. After all surfaces to be sodded have been topsoiled to the sod sub-grade, the Contractor shall furnish and apply limestone as herein specified.

C. Limestone shall be applied at the rate determined by the results of laboratory tests conducted at a certified testing laboratory at the Contractor's expense.

D. Lime shall be mechanically spread at the rate determined by testing on all areas which are to be sodded up to a slope gradient of twenty-five percent (25%).

E. The lime shall be distributed uniformly and worked into the top four (4) inches minimum of the topsoil areas designated for sodding by discing or rototilling and shall be uniformly blended into the topsoil.

3.03 FERTILIZER

A. After the liming and tilling has been approved by the Engineer, the Contractor shall apply fertilizer to all areas to be sodded. All fertilizer shall be uniformly spread by a mechanical spreader at the rate recommended by the testing laboratory. Fertilizer shall not be applied during the months of June, July or August.

B. After the areas to be sodded have been properly fertilized, the Contractor shall hand rake the fertilizer into the topsoil to a minimum depth of one (1) inch so that the material is uniformly blended by means of garden rakes. During this raking process, the areas to be sodded shall be cleared of all stones over one (1) inch in size and all other unsuitable material. All such undesirable material shall be removed from the site. These areas shall be fine graded to achieve sod sub-grade after compaction which shall be obtained by rolling, dragging or by an approved method which obtains an equivalent compaction to that produced by a hand roller weighing from 75 to 100 pounds per foot of width. All depressions caused by settlement or rolling shall be filled with additional topsoil and re-graded and prepared as specified above until it presents a reasonable smooth and even finish at the required sod sub-grade.

C. At least four (4) days shall elapse after the application of lime and fertilizer before sodding shall begin.

3.04 SODDING

A. After the preparation of the areas to be sodded has been reviewed by the Engineer, the Contractor shall sod the areas as specified herein.

B. In accordance with the rectangular sod strips measuring twelve (12) inches or sixteen (16) inches in width and from four (4) feet to six (6) feet in length the following provisions shall apply:

1. All sod shall be placed with close joints and no overlapping by whatever method is chosen. Sod shall be laid in strips, edge to edge, with the lateral joints staggered. All minor or unavoidable openings in the sod shall be closed with sod plugs. However, sod laid with joints determined by the Engineer to be too large shall be lifted and relaid to the Engineer's satisfaction at no extra cost to the Owner. On slope areas exceeding twenty-five percent (25%) gradient, the Contractor shall secure sod by pegging each strip five (5) feet on center.

C. In accordance with the "Big Roll" method of furnishing and installing sod, the following provisions shall apply:

1. Only sod harvested with a "Big Roll" (Sod-O-Matic) harvester as supplied by the Tuckahoe Turf Farm or the Kingston Turf Farm, or equal, shall be permitted.

2. Sod so harvested shall be stored, delivered and unloaded while rolled on the manufacturer's specially made tubes which permit the rolling and storage of three (3) sixteen (16) inch wide sod strips, a maximum of fifty (50) feet in length and stored side by side.

3. Sod shall be installed by means of the **Big Roll Laying Device** as manufactured by the KWMI Turf Equipment, refer to Appendix E or equal which is available on loan or by purchase from the specified sod suppliers or manufacturers. This device is available in both mechanical or hydraulic models. Small areas may be laid by hand at the Contractors discretion.

4. The Contractor shall be required to borrow, rent or buy this "Laying Device" for use in the sod installation and shall utilize a tandem wheel tractor or one equipped with high flotation tires which has a three point hitch.

5. The sod shall be laid only by persons instructed by and in the presence of the sod supplier's representative until such time as the representative is satisfied that the Contractor's forces are sufficiently experienced in the proper use of the tractor, the Laying Device and supplementary sod-laying procedures. The Contractor shall be wholly responsible for the installation.

6. The prepared topsoil shall be so prepared so as to permit use of the tractor and laying device without causing depressions, ruts, etc., in the smooth finished surface to be sodded. Any depressions caused by the Contractor shall be remedied at no extra cost to the Owner.

7. The topsoil shall not be moist at the time of installation; however, it shall contain sufficient moisture so as not to be powdery or dusty, both as determined by the supplier's representative.

8. At slopes exceeding twenty-five percent (25%) in gradient, sod shall be installed manually as specified herein and not by the "Big Roll" system.

9. The sod shall be uniformly distributed over the prepared topsoil bed and pulled tightly against the edges of previously laid sections by laborers with garden rakes so as to insure tight joints and to prevent drying of the sod at the joints.

D. All sod shall be placed with close joints with no overlapping by whatever method is chosen. The overlapping of existing lawn with new sod along limit of work lines shall not be permitted. All new work shall abut existing lawn to match existing grades along a cut and prepared edge. Sod shall be laid in strips, edge to edge, with the lateral joints staggered. All minor or unavoidable openings in the sod shall be closed with sod plugs or with topsoil. However, sod laid with joints determined by the Engineer to be too large shall be lifted and re-laid in accordance with these specifications at no extra cost to the Owner. On slope areas exceeding a twenty-five percent (25%) gradient, the Contractor shall secure sod by pegging each strip five (5) feet on center.

E. The sod must be watered on the same working day on which it is installed. If necessary, the Contractor shall provide special crews after normal working hours to accomplish such watering at no extra cost to the Owner. After this initial watering, the Contractor shall be required to furnish, install and maintain a system of temporary pipe, sprinklers and service connections which are adequate to water the sod weekly with the equivalent of one (1) inch rainfall. During the first week of the sod installation, watering shall be accomplished daily with a sufficient quantity of water to penetrate through the sod and into the sub-base. If the sod is watered by normal rainfall or if weather conditions dictate, the Contractor may, at his discretion, eliminate or increase watering during a given week. However, such action by the Contractor shall in no way waive the Contractor's responsibility for the growth and health of the grass until final acceptance of the sodding.

F. If, in the opinion of the Engineer, rolling of the sod is required to properly joint the sod to the bed after the sod is laid and twenty-four (24) to forty-eight (48) hours after initial watering, the Contractor shall roll the required area with a roller which weighs from seventy-five (75) to one hundred (100) pounds per square foot of roller width at no extra cost to the Owner.

G. The completed sodded surface shall be true to finish grades shown and even and firm at all points.

3.06 PROTECTION AND MAINTENANCE

A. Maintenance shall begin immediately after sod is installed and shall continue in accordance with the following:

B. <u>Sod</u>

1. Sod shall be maintained until final acceptance of the project or a minimum of 90 days, whichever is longer.

a. Following final acceptance of field, contractor shall provide the owner with a season maintenance schedule which shall outline not only appropriate methods of maintenance but schedule of watering and fertilizer treatments.

2. In the event that lawn operations are completed too late in the fall for adequate growth of grass, maintenance shall continue into the following spring growing season at least eight weeks.

3. Water sodded areas as necessary to supplement natural rain to the equivalent of one (1) inch rainfall per week and as follows:

a. Lawns shall be watered in a satisfactory manner during and immediately after installation and not less than twice per week, until acceptance.

b. Suitable water for planting and maintenance of lawns shall be provided by the General Contractor.

c. The Contractor shall furnish his own hose and hose connections from the outlets where water is furnished. Provide all necessary watering equipment.

d. Adjust approved schedule to fit weather and soil conditions.

e. Mow grass as required. Remove grass clippings.

f. Apply specified fertilizer over entire lawn area after six (6) weeks at rate of fifteen (15) pounds per one thousand (1,000) square feet.

g. Eliminate weeds by physical methods approved by the Engineer

h. Repair bare spots and/or damage resulting from erosion, gullies, washouts, or other causes by filling with topsoil, tamping, refertilizing and resodding by the Contractor at his expense, if such damage occurs prior to acceptance. Sod shall be of same seed mixture as specified. If not weed-free, spraying shall be required.

i. At no time after the placement of the root-zone-mix or sod shall heavy equipment or vehicles not intended for the express purpose of turf maintenance be driven over the turf establishment area. If this occurs, sod shall be removed from the entire compacted area, the root-zone-mix shall be scarified, compacted to the specified compaction level, and sod shall be replaced as outlined in this section of the specifications at no cost to the owner.

3.07 CLEAN-UP

A. Pavements shall be broom cleaned and kept clear at all times during construction.

B. After completion of all landscaping work, dispose of all debris and excess material, to satisfaction of the Engineer. All pavements shall be broomed and hosed clean.

C. Special considerations should be made not to disturb any existing sports field appurtenances including but not limited to the athletic track surface surrounding the field.

3.08 INSPECTION AND ACCEPTANCE

A. Sod will be inspected upon delivery to the site and is subject to the Engineer's approval.

B. No sod will be accepted until maintenance has been provided in accordance with 3.06 above and until healthy and vigorously turf conditions prevail.

END OF SECTION

SECTION 02930

TREES, SHRUBS, GROUNDCOVERS, AND LANDSCAPING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section includes furnishing all labor, materials, equipment, plants, and incidental materials necessary to perform all operations related to the planting of all trees, shrubs, vines, herbaceous plants, ground covers, and for all appurtenant work, complete in place, maintained, and accepted, in accordance with the Contract Drawings and Specifications.

B. The Contractor shall bear the responsibility and cost of furnishing and applying water or any other substances, as necessary to ensure the sustainability of plant materials, as part of the work of this contract.

1.02 RELATED WORK:

A. Section 02329, LOAM BORROW

B. Section 02290, SEEDING

C. Section 02923, SODDING

1.03 SUBMITTALS:

In accordance with requirements of the general specifications, the Contractor shall submit the following:

A. Prior to planting, State nursery inspection certificates for all plant materials shall be submitted to the Engineer for review.

B. Samples and six copies of the manufacturer's product data, as applicable, shall be submitted to the Engineer for review and approval for the following materials:

1. Limestone.

2. Fertilizer.

3. Sphagnum Peat Moss.

4. Humus.

5. Organic Compost.

6. Manure.

7. Mulch.

8. Guying and Staking Apparatus.

9. Crepe Wrapping for tree trunks.

10. Anti-transpirant/Anti-desiccant.

PART 2 - PRODUCTS

2.01 PLANT MATERIALS:

A. The Contractor shall furnish and plant all plant materials as shown on the plans and in the quantities and sizes listed thereon. No substitutions shall be permitted without the written approval of the Engineer.

B. Plants larger than those specified in the Plant List may be used if approved by the Engineer. However, use of such oversized plants shall not be considered grounds for any increase in the contract price. If the use of larger plants is approved, the required spread of roots or ball of earth shall be increased in proportion to the size of the plant and plant pits shall be increased as necessary.

C. All plants shall be certified to have passed all required Federal and State inspection laws requiring ensuring freedom from plant diseases and insect infestations. The Contractor shall obtain clearance from applicable governing agencies, as required by law, before planting any plants delivered from outside the state in which they are to be planted.

D. All plants shall be nursery-grown under climatic conditions and environmental stresses similar to those in the locality of the project. All plants shall originate from nurseries that are no more than one Hardiness Zone higher (as established by the Arnold Arboretum, Jamaica Plain, MA) than where the plant is to be installed. Plants also shall conform to the botanical names and standards of size, culture, and quality for the highest grades and standards as adopted by the American Association of Nurserymen, Inc. in the American Standard for Nursery Stock, ANSI-Z60.1, latest edition. All plants shall be legibly tagged with their proper botanical name.

E. No heeled-in plants or plants from cold storage shall be used. All plants shall be typical of their species or variety and shall have a normal habit of growth. Plants shall be sound, healthy, and vigorous, well branched and densely foliated when in leaf; shall be free of disease, insects, eggs or larvae; and shall have healthy, well-developed root systems. All parts of the plant shall be moist and shall show active green cambium when cut.

F. All nursery plants shall be balled and burlapped or container-grown and shall have been acclimatized for at least one growing season. Container-grown stock shall have been grown in a container long enough for the root system to have developed sufficiently to hold its soil together, firm and whole, after removal from the container. No plants shall be loose in the container. Container-grown plants shall have no girdling roots and shall not be in a root-bound condition. Plants shall remain in their container until planted.

G. Care shall be exercised in digging and preparing field-grown plants for shipment and planting. Balled and burlapped materials shall have solid unbroken balls of earth of sufficient size to encompass all fibrous feeding roots necessary to ensure successful recovery and development of the plants. Balls shall be firmly wrapped in untreated biodegradable burlap and tied securely with wire cages and/or jute twine. Roots or balls of plants shall be adequately protected at all times from sun and drying winds. No plant shall be accepted when the ball of earth surrounding its roots has been badly cracked or broken preparatory to or during planting, or after the burlap, staves, wire cage, rope, or platform in connection with its transplanting have been removed. Soil characteristics (i.e., composition, texture, pH, etc.) of all field-grown plants shall closely match those of the soil where plant materials are to be planted.

H. The height of the trees, measured from the crown of the roots to the top of the top branch, shall not be less than the minimum size designated in the Plant List in the Drawings. The branching height for deciduous trees installed adjacent to or within walks shall be 7 feet minimum, having been pruned to this height at least 1 year prior to transplanting. Except when a clump is designated, the trunk of each tree shall be a single trunk growing from a single, unmutilated crown of roots. No part of the trunk shall be conspicuously crooked as compared with normal trees of the same variety. The trunk shall be free from sunscald, frost cracks, or wounds resulting from abrasions, fire, or other causes. All pruning cuts shall comply with acceptable horticultural practices. No pruning wounds having a diameter of more than 1½-inches shall be present. Any such wounds must show vigorous bark growth on all edges. Evergreen trees shall be branched to within 1 foot of the ground. No tree that has had its leader cut or die shall be accepted.

I. Caliper measurements for tree trunks shall be taken 6-inches above ground for trees up to and including 4-inch caliper size and at 12-inches above ground for larger sizes.

J. Shrubs shall meet the requirements for spread and/or height stated in the Plant List on the Drawings. The measures for height are to be taken from the crown or root flare to the average height of the top of the shrub mass (not the longest branch). The fullness of each shrub shall correspond to the trade classification "No. 1". Single stemmed or thin plants will not be accepted. The side branches must be generous, well-twigged and the plant as a whole must be well-bushed to the ground. The plants must be in a moist, vigorous condition, free from dead wood, bruises or other root or branch injuries.

K. Herbaceous plants, vines and groundcovers shall be of the size, age and/or condition designated in the Plant List on the Drawings.

L. Plants shall be delivered only after preparations for planting have been completed. Plants shall be handled and packed in a horticulturally approved manner and all necessary precautions shall be taken to ensure that plants arrive on-site in a healthy vigorous condition. Trucks used for transporting plants shall be equipped with covers to protect plants from windburn, desiccation, and overheating during transport. Plants that have not been thoroughly watered shall not be accepted at the planting site. Any plants delivered to the site in a dry or wilted condition shall be rejected and replaced at no expense to the Owner. All plant materials shall be protected, watered and otherwise maintained prior to, during, and upon delivery to the site.

M. Plants shall be subject to inspection and approval by the Engineer at the place of growth, or upon delivery, for conformity to specification requirements as to quality, size, variety, and condition. Inspection and selection of plants before digging shall be at the option of the Engineer. The Contractor, or his representative, shall be present, if requested by the Engineer, for inspection of plants at the Nursery. Such approval shall not impair the right of inspection and rejection upon delivery at the site or during the progress of work, for size and condition of balls and roots, disease, insects and latent defects or injuries. Rejected plants shall be removed immediately from the site. Certificates of inspection of plant materials shall be furnished as may be required by Federal, State and other authorities to accompany shipments.

2.02 LOAM BORROW:

Loam Borrow shall be as specified in Section 02329, LOAM BORROW.

2.03 SOIL ADDITIVES AND AMENDMENTS:

A. LIMESTONE:

Lime shall be an approved agricultural limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide). The material will be ground such that 50 percent of the material will pass through a No. 100 mesh sieve and 98 percent will pass a No. 2 mesh sieve. Lime shall be uniform in composition, dry and free-flowing and shall be delivered to the site in the original sealed containers, each bearing the manufacturer's guaranteed analysis.

B. FERTILIZER:

1. Fertilizer shall be a complete, standard commercial fertilizer, homogeneous and uniform in composition, dry and free-flowing, and shall be delivered to the site in the manufacturer's original sealed containers, each bearing the manufacturer's guaranteed analysis and marketed in compliance with State and Federal Laws. All fertilizer shall be used in accordance with the manufacturer's recommendations.

2. Fertilizer for tree, shrub and groundcover plantings shall contain all major plant nutrients and minor trace elements essential to sustain plant growth and shall have the following analysis:

Nitrogen (N)	Phosphorous (P)	Potassium (K)
10%	10%	10%

3. As approved by the Engineer, a slow release root contact fertilizer installed at the time of planting, may be used in place of the above, at the discretion of the Contractor.

C. Organic Compost shall be a standard commercial product comprised of fully decomposed, 100 percent plant-derived, natural organic matter. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Compost shall be free of sticks, stones, weed seeds, roots, mineral or other foreign matter and delivered air dry. It shall be free from excessive soluble salts, heavy metals, phytotoxic compounds, and/or substances harmful to plant growth and viability. Organic compost shall have an acidity range of 4.5 to 7.0 pH.

D. Sphagnum Peat Moss shall be a standard commercial product. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Peat moss shall be free of sticks, stones, weeds or weed seeds, roots, mineral or other foreign matter. It shall be free from toxic substances and/or compounds harmful to plant growth and viability. It shall be delivered air dry in standard bales and shall have an acidity range of 3.5 to 5.5 pH.

E. Humus shall be natural humus, reed peat, or sedge peat. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Humus shall be free of sticks, stones, weeds, roots, mineral or other foreign matter and/or toxic substances harmful to plant growth and viability. It shall be low in wood content, free from hard lumps and excessive amounts of zinc and delivered air dry in a shredded or granular form. The acidity range for humus shall be 5.5 to 7.5 pH, and the organic matter content shall be not less than 85 percent, as determined by loss on ignition. The minimum water holding capacity shall be 200 percent by weight on an oven-dry basis.

F. Manure shall be well-rotted, leached, cow manure not less than 8 months or more than 2 years old. It shall be free of sawdust, shavings, or refuse of any kind and shall not contain more than 25 percent straw. It shall contain no substances harmful to plant growth. The Contractor shall furnish information regarding chemical disinfectants, if any, that may have been used in storage of the manure.

2.04 PLANTING MIXTURE:

Planting mix shall consist of 7 parts loam borrow and 1 part organic compost, humus, sphagnum peat moss, or manure, thoroughly blended.

2.05 WATER:

Water shall be furnished by the Contractor, unless otherwise specified, and shall be suitable for irrigation and free from ingredients harmful to plant growth and viability. The delivery and distribution equipment required for the application of water shall be furnished by the Contractor, at no additional cost to the Owner.

2.06 MULCH:

Mulch shall be fibrous pliable shredded black organic softbark mulch, not exceeding ½-inch in width. It shall be 98 percent organic matter with a pH range between 3.5 and 4.5 and a moisture content not to exceed 35 percent. It shall be free of weeds, weed seeds, debris, and other materials harmful to plant growth and viability. Organic mulch shall be aged no longer than 2 years.

2.07 MATERIALS FOR STAKING, GUYING, AND WRAPPING:

A. Tree stakes shall be sound, untreated 2 x 3 (nominal) x 8-foot length Douglas Fir reasonably free of knots. No paint or stain shall be used in conjunction with tree stakes. Tying material shall be flexible braided nylon webbing, ¾-inch wide and have a tensile strength of 900 pounds. Webbing shall be 'ArborTie', or approved equal.

B. Drive anchors and guy wire assemblies shall be suitable for protecting trees and shall be sized in accordance with the manufacturer's recommendations. No materials shall be used for guying that will girdle, chafe, or otherwise injure trees.

C. Tree wrap shall be duplex, waterproof kraft paper crinkled to 33-1/3 percent stretch, 4- to 6-inch wide strips. Tying materials shall be jute twine, 2-ply for shrubs and trees less than 3-inch caliper; 3-ply for larger plants.

2.08 TREE PAINT:

Tree paint shall not be used.

2.09 ANTI-TRANSPIRANT/ANTI-DESICCANT:

Anti-transpirant or anti-desiccant shall be 'Wilt-Pruf', as manufactured by Nursery Specialty Products, Inc., Groton Falls, NY, or approved equal. It shall be delivered in original sealed manufacturer's containers and used in accordance with the manufacturer's instructions.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. All plants shall be subject to inspection and approval by the Engineer upon delivery to the site. No materials shall be planted until approval is received.

B. All work shall be performed by skilled workers with a minimum of 2 years planting experience, in accordance with accepted horticultural/nursery practices, under the full-time supervision of a Certified Nurseryman or Arborist.

C. All balled and burlapped plants that cannot be planted immediately upon delivery shall be set on the ground and the root balls shall be well protected with soil, wet moss, or other acceptable material. All foliage shall be protected and covered with perforated shade materials.

D. The planting season for evergreen trees and shrubs shall extend from the time the soil becomes workable in the spring until new growth appears, and from September 15 until November 30 in the fall. Deciduous trees and shrubs shall be planted only when dormant, either prior to bud break and/or before leaves appear in the spring, or subsequent to their leaf drop in the fall. Ground covers shall be planted only after the last frost in the spring through mid-May. Planting season periods may be extended if weather and soil conditions permit only with the written approval of the Engineer. Extended or out-of-season planting requirements shall include application of antitranspirant and extra water as needed. Plant guarantee periods shall remain as stated below. Planting shall not be permitted in frozen ground.

E. All plant locations and outlines for planting beds shall be staked out for review and potential adjustment by the Engineer before any excavation is begun. In the event that rock, underground construction work or obstructions are encountered in any proposed planting pit or bed, the Engineer may select alternate locations. Where locations cannot be changed, the obstruction shall be removed, subject to the Engineer's approval, to a depth of not less than 3 feet below grade and not less than 6-inches below the bottom of the root ball when plant is properly set at the required grade. Removal of boulders or obstructions greater than 1 cubic yard in size shall be subject to approval and will be paid for by the Owner. No ledge will be removed to create planting pits or beds

F. All planting pits shall be excavated with sloped walls, wider at the top than at the bottom, and scarified to eliminate glazing. Tree pits shall be at least 2 feet greater in diameter than the root ball of earth or root system. Shrub pits shall be at least 1 foot greater than the diameter of the root ball. Planting pits shall not be deeper than the height of the root ball.

G. When excavation occurs in areas of heavily compacted earth, stones, concrete chunks or other foreign matter, pits shall be dug at least 3 times the width of the rootball. Excavated material from plant pits shall be disposed of as required.

H. Container plants shall be removed from their growing container before planting. If roots are densely matted, the outer root mass shall be scored, sliced vertically, with a sharp knife to separate roots. All herbaceous plants and groundcovers shall be evenly

spaced to produce a uniform effect and staggered in rows at intervals designated on the contract drawings.

I. Shrubs and trees shall be set in the center of planting pits, plumb and straight, and at such a level that after settlement the crown of the roots will be 1-inch above the surrounding finished grade. Root ball masses shall not be loosened, broken or damaged. When balled and burlapped plants are set, planting mixture shall be compacted around bases of balls to fill all voids. All tying materials, twine and rope shall be cut and removed. Biodegradable burlap shall be laid back or cut away from the top half of the ball. If a wire basket is present, the upper 2/3 of the basket shall be cut away and removed. Do not remove the entire basket. Roots or bare root plants shall be properly spread out and planting mixture carefully worked in among them. Broken or frayed roots shall be cleanly cut.

J. Backfill plant pits with planting mixture in layers of not more than 9-inches and firmly tamp each layer and water to sufficiently settle the backfilled soil before the next layer is put in place. When the planting pit is 2/3 backfilled, the hole shall be flooded and watered thoroughly so that the water level reaches the top of the planting pit. Allow water to soak in, then complete the backfilling operation. Immediately after planting pit is backfilled, a shallow basin 3-inches deep and slightly larger than the pit shall be formed with a ridge of soil for water retention. Form a common basin for plant materials throughout mass planting beds. After planting, lightly till the soil in planting beds between planting pits and rake smooth to eliminate compaction of soils.

K. All planting hole basins shall be flooded with water twice within the first 24 hours of planting, and watered not less than twice per week until final acceptance of the work.

L. All thin barked deciduous trees shall be wrapped after they are planted and before they are staked. Prior to wrapping, inspect trees for injury to trunks or improper pruning. Take corrective measures as necessary. Wrap trunks of all trees spirally from bottom to top with tree wrap and secure top and bottom at 2-foot intervals with jute twine. 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.

M. Stake trees immediately after planting as detailed. All staking apparatus shall be adequate to hold the tree in a vertical position under severe weather conditions. All staking apparatus and tree trunk wrapping shall be removed and disposed of off-site by the Contractor at the end of one growing season.

N. Immediately after planting and staking operations are complete, all plant pit basins and plant beds shall be covered with approved mulch to the depths designated on the plans. Mulch shall not contact tree bark, cover tree root flares, or shrub crowns. No mulch shall be applied prior to the first watering.

O. The pruning of trees and shrubs shall only be permitted to remove dead or dying branch limbs and tips, sucker growth, water sprouts, crossing or rubbing branches, broken or damaged branches, diseased or insect infested limbs, and to preserve the natural

character of the plant. Plant materials shall be pruned in accordance with American Nurserymen Association Standards and as required by the Engineer. Questionable weak limbs and branch removals that may disfigure the plant shall be left to the discretion of the Engineer. The tree leader shall never be permitted to be cut. Pruning shall be done with clean, sharp tools. All large pruning cuts that are ½-inch in diameter or larger shall be made along the bark branch ridge. Pruning cuts shall not breach or otherwise interfere with the branch collar. All pruning cuts less than ¼-inch diameter shall be made with hand pruners as close to the main stem as possible without damaging the cambium or bud. Tree paint shall not be used to cover pruning cuts.

P. As the work proceeds, the Contractor shall remove all debris from the site, including but not limited to branches, rock, paper, and rubbish. All areas shall be kept clean, neat and in an orderly condition at all times. Prior to final acceptance, the Contractor shall cleanup the entire area to the satisfaction of the Engineer.

3.02 MAINTENANCE:

A. Maintenance shall begin immediately after each plant is planted and shall continue until completion of the guarantee period and final acceptance of the project. Plants shall be watered, pruned, sprayed, fertilized, cultivated and otherwise maintained and protected. Tree guys and stakes shall be tightened and repaired. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit.

B. Settled plants shall be reset to proper grade and position, planting pits and common basins restored, and dead materials removed and replaced. Planting beds and individual basins shall be neat in appearance, maintained to their original layout lines and kept free of weeds. Mulch shall be replaced as required to maintain proper depths.

C. Contractor shall make arrangements to provide sufficient water to maintain all trees, shrubs and plant materials until final acceptance. Plants shall be sprayed with anti-transpirant or anti-desiccant if required by seasonal conditions or as required by the Engineer.

D. Planting areas shall be protected against trespass and damage of any kind during the maintenance period. This shall include the furnishing and installation of approved temporary fencing if necessary. If any plants become damaged during the maintenance period, they shall be treated or replaced as required by the Engineer at no additional cost to the Owner.

3.03 INSPECTION AND PRELIMINARY ACCEPTANCE:

A. Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of inspection for preliminary acceptance. The Engineer shall recommend preliminary acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals or replacements.

B. Inspection and acceptance of plantings may be requested and granted in part, provided the areas for which acceptance is requested are relatively substantial in size, and with clearly definable boundaries. Acceptance and use of these areas by the Owner shall not waive any other provisions of this Contract.

3.04 GUARANTEE:

A. All plant materials shall be guaranteed for a period of one year after the date of completion of the specified maintenance period and preliminary acceptance of the project by the Owner.

B. When the work is accepted in part, the guarantee period shall extend from each partial acceptance to the terminal date of the last guarantee period. All guarantee periods terminate at one time.

C. Plants shall be healthy, free of pests and disease. Plants shall exhibit vigorous growth, shall bear foliage of normal density, size and color and shall have no less than seventy-five percent (75%) of their branches alive at the end of the guarantee period. If the leader of any single-leader species is dead, the entire plant shall be considered dead.

D. Any plant required under this Contract that is dead or unsatisfactory, as determined by the Engineer, shall be removed from the site. These shall be replaced as soon as weather permits during the specified planting season, at no additional cost to the Owner, until the plants live through one year.

E. All replacements shall be plants of the same kind and size as specified on the Plant List. They shall be furnished and planted as specified above.

F. The guarantee of all replacement plants shall extend for an additional one-year period from the date of their acceptance as replacement.

G. Guarantee shall not apply to the replacement of unacceptable plants resulting from the removal, loss, or damage due to occupancy of the project in any part; vandalism or acts of neglect on the part of others; physical damage by animals, vehicles, etc.; and Acts of God, including but not limited to, catastrophic fire, hurricanes, riots, war, etc.

H. In the instance of curtailment of water by local water authorities (when supply was to be furnished by the Owner), the Contractor shall furnish all necessary water by water tanker, the cost of which will be approved and paid for by the Owner.

3.05 FINAL INSPECTION AND FINAL ACCEPTANCE:

A. At the end of the guarantee period, the Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of final inspection for final acceptance.

B. The Engineer shall recommend final acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals or replacements.

END OF SECTION

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SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section of the specifications covers the furnishing and installation of forms for cast-in-place concrete.

1.02 RELATED WORK:

A. Section 03200, CONCRETE REINFORCEMENT

B. Section 03300, CAST-IN-PLACE CONCRETE

1.03 REFERENCES:

The following standards form a part of this specification:

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301 Standard Specifications for Structural Concrete

ACI 347 Recommended Practices for Concrete Formwork

U.S. ARMY CORPS OF ENGINEERS (CE)

CE 03300 Cast-in-Place Concrete

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Forms for exterior and interior surfaces which will be exposed to view after the work is completed, whether such surfaces are painted or unpainted, shall be new plywood stock, steel, tempered masonite, or other materials which will provide smooth concrete surfaces without subsequent surface plastering. Plastic or plastic-faced forms shall not be used, except with the prior approval of the Engineer.

B. Form Ties

1. Provide factory-fabricated, adjustable length, removable or snap off metal form ties, designed to prevent form deflection and to prevent spalling of concrete surfaces upon removal.

2. Provide ties so that the portion remaining within concrete after removal of exterior parts is at least 1-1/2 inches from the outer concrete surface. Provide form ties, which will not leave a hole larger than one inch diameter in the concrete surface.

C. Form release agent shall be a non-staining, non-yellowing, non-toxic liquid free from kerosene and resins of the type recommended by the manufacturer of the forming system being used such as EZ strip by L&M Construction Chemicals, Omaha, NB and "Magic Kote" by Symons Corp., Des Plaines, IL or approved equal.

D. Where steel adjacent to vertical faces of forms cannot be otherwise secured, mortar doughnuts shall be used to prevent steel from lying too close to the finish vertical faces of the concrete.

PART 3 - EXECUTION

3.01 PREPARATION:

Surfaces of forms to be in contact with concrete shall be greased with non-staining form release compound. Wetting will not be accepted as a substitute. Approval of the Engineer shall be obtained before use of coated materials or liners in lieu of form release compound, except as modified herein.

3.02 CONSTRUCTION:

A. For concrete surfaces which will be visible after completion of the structure, painted or unpainted, the type and the precise location of form ties, nails joints between form members, and any other features which will leave a visible trace in the finished concrete, will be subject to the approval of the Engineer.

B. Formwork shall be so constructed, braced, or tied that the formed surfaces of the concrete will be perfectly true, smooth, and to the dimensions shown on the drawings. All forms used for circular sections shall be true arcs as indicated on the drawings. Short chords will not be acceptable. Form line shall present an uninterrupted surface conforming to radii indicated on the drawings.

C. Forms shall be sufficiently tight to prevent leakage of mortar, and when necessary shall have temporary openings as required for thorough cleaning, and as required for introduction of concrete to avoid excessive free fall. Panels damaged in stripping or otherwise shall not be reused.

D. Unless otherwise noted on the design drawings, forms shall be filleted and chamfered at all sharp corners, and exposed edges with a 3/4-inch chamfer. Chamfer shall not be used where masonry or other material will subsequently be installed flush with one of the adjacent surfaces of the concrete. Where a wash or slope is indicated on the drawings no additional chamfer is required.

3.03 REMOVAL OF FORMS

A. REMOVING FORMS AND SUPPORTS:

1. Removal of forms shall take place in accordance with ACI 347, Section 3.6. Except as otherwise specifically authorized by the Engineer, forms shall not be removed until the concrete has aged for the following number of day-degrees or attained 50 percent strength. (Day-degrees equals the total of number of days times the average daily air temperature at the surface of concrete. For example, 5 days at a daily average temperature of 60°F. equals 300 day-degrees.)

Location	Day-Degrees
Beams and Slabs	500
Walls and Vertical Surfaces	200

B. Where beams, girder, columns, walls and similar vertical forms are adequately supported on shores, the side forms may be removed after 24 hours of cumulative curing time provided the side forms support no loads other than the lateral pressure of the plastic concrete. Cumulative curing time represents the sum of time intervals, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above 50 deg. F in accordance with American Concrete Institute standards.

C. Shoring shall not be removed until the concrete has attained at least 70 percent of the specified strength and sufficient strength to support safely its own weight and the construction live loads upon it.

D. Forms shall be removed in such a manner as not to impair safety and serviceability of the structure. Concrete exposed by form removal shall have sufficient strength not to be damaged by the removal operation.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section of the specification covers the furnishing and installation of reinforcement for cast-in-place concrete.

1.02 RELATED WORK:

A. Section 03100, CONCRETE FORMWORK

B. Section 03150, WATERSTOPS

C. Section 03300, CAST-IN-PLACE CONCRETE

1.03 SYSTEM DESCRIPTION:

Materials and construction shall conform to ACI 318 and ACI 350 unless otherwise noted on the design drawings or modified herein.

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. The Contractor shall furnish the Engineer with complete checked, reinforcing steel shop drawings and bar lists. Shop drawing shall include grade of steel used as well as splice lengths.

B. Mill test reports shall accompany drawings. Fabrication shall not commence until the drawings and mill test reports have been released by the Engineer.

C. When fiber reinforcement is used, contractor shall submit manufacturer's data confirming that material meets the specification.

1.05 REFERENCES:

A. The following standards form a part of these specifications:

American Concrete Institute (ACI)

ACI	318	Building Code Requirements for Structural Concrete
ACI	347	Recommended Practice for Concrete Formwork

ACI 350 Code Requirements for Environmental Engineering Concrete Structures

ACI SP-66 ACI Detailing Manual

American Society for Testing and Materials (ASTM)

ASTM A185 Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement

ASTM A497 Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement

ASTM A6l5 Deformed Billet-Steel Bars for Concrete Reinforcement

ASTM A775 Epoxy-coated Reinforcing Steel Bars

ASTM A884 Epoxy-coated Welded Wire Fabric

American Welding Society (AWS)

AWS 12.1 Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Steel reinforcing bars shall conform to ASTM A6l5, Grade 60, and A775 if epoxy-coated bars are specified.

B. Welded steel wire fabric shall conform to ASTM A185 or ASTM A497 and ASTM A884 if epoxy-coated fabric is specified. Gauge and spacing of wires shall be as indicated on the drawings.

C. Reinforcing steel shall be detailed in accordance with ACI SP-66 modified as applicable to conform to ACI 350.

D. Reinforcement shall be accurately formed to the dimensions indicated on the drawings. Bars shall be shipped to the site with bars of the same size and shape, fastened in bundles with securely wired-on metal identification tags listing both size and mark.

E. Any bar showing cracks after bending shall be discarded.

F. Steel failing to meet the requirements of this specification or the drawings will be rejected and shall be removed from the site immediately.

2.02 FIBER REINFORCEMENT

When called for on the drawings, concrete engineered reinforcing fibers shall be polypropylene, collated, fibrillated fibers from Fibermesh Co., 4019 Industry Drive, Chattanooga, TN; Forta Corporation, One Hundred Forta Drive, Grove City, PA; or approved equal. Only fibers designed and manufactured specifically for use in concrete from virgin polypropylene and so certified by the manufacturer shall be acceptable.

PART 3 - EXECUTION

3.01 STEEL INSTALLATION:

A. Before being placed in position, reinforcement shall be thoroughly cleaned of loose mill and rust scale, dirt, and other coatings (including ice), that reduce or destroy bond. When there is a delay in depositing concrete after reinforcement is in place, bars shall be reinspected and cleaned as necessary.

B. After forms have been oiled, but before concrete is placed, all steel shall be securely wired in the exact position called for, and shall be maintained in that position until all concrete is placed and compacted. Chair bars and supports shall be provided in a number and arrangement satisfactory to the Engineer.

C. Concrete blocks having a minimum bearing area of 2-inches by 2-inches and equal in quality to that specified for the slab, shall be used for supporting reinforcing bars for slabs on grade. Wood blocks, stones, brick chips, etc., shall not be used to support reinforcement.

D. Metal supports shall be of types that will not penetrate the surface of formwork or slab and which will not show through or stain surfaces that are to be exposed to view, painted or unpainted.

E. Welding of reinforcing bars will be permitted only where permission of the Engineer has been obtained in advance. Such welding shall be performed only under conditions established by the Engineer, and in accordance with AWS 12.1.

F. Reinforcement, which is to be exposed for a considerable length of time after having been placed, shall be painted with a heavy coat of cement grout, if required by the Engineer.

3.02 FIBER INSTALLATION:

A. Fibermesh fibers shall be used in concrete as indicated on the drawings or as specified and in strict accordance with the manufacturer's recommendations as to type and amount. The fiber manufacturer or approved distributor shall provide the services of a qualified employee for pre-job meeting and initial job start up.

END OF SECTION

SECTION 03301

CAST-IN-PLACE CONCRETE

PART 1 -GENERAL

1.01 GENERAL PROVISIONS:

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK:

A. Work Included: This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:

1. Footings
2. Foundation walls
3. Exterior slabs-on-grade, sidewalks
4. Grout

B. Items To Be Installed Only: Foundation connection hardware provided by prefabricated building manufacturer.

C. Items To Be Furnished Only: Not applicable.

D. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 01450, STRUCTURAL TESTS AND INSPECTIONS
2. Section 02300, EARTHWORK; Excavation and establishment of subgrade elevations.
3. Section 02888, MODULAR BATHROOM BUILDING

1.03 SUBMITTALS:

A. Refer to Section 01330, SUBMITTALS for submittal provisions and procedures.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water-stops, joint systems, curing compounds, dry-shake finish materials, and others if requested by the Engineer or SER.

C. Shop drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing and supports for concrete.

D. Submit shop drawings for all formwork for Architecturally Exposed Concrete (Concrete Exposed to View) showing cone tie patterns.

E. Concrete mix design for each mix specified. Supporting test data shall be submitted if requested.

1. Submit alternate mix designs when the characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
2. Indicate the amounts of mixing water to be withheld for later addition at the Project site.

F. Proposed method of curing and associated products.

G. Proposed precautions for hot weather and cold weather concreting.

H. Samples: For waterstops and vapor retarder.

1. Submit samples of materials as requested by the Engineer or SER, including names, sources, and descriptions.

I. Laboratory test reports for concrete materials and mix design test.

J. Material test reports for the following, from a qualified testing agency, indicating compliance with specification requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

K. Material certificates for each of the following, signed by the manufacturers:

1. Cementitious material.
2. Admixtures
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Non-metallic shrinkage resistant grout.
6. Waterstops.
7. Curing compounds.

8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semi-rigid joint filler.
13. Joint-filler strips.
14. Repair materials.

L. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

M. Qualification Data: For Installer and Manufacturer.

N. Minutes of pre-installation conference

1.04 QUALITY ASSURANCE:

A. Installer Qualifications: A qualified installer who employs on the Project personnel qualified as ACI certified Flatwork Technician and Finisher and a supervisor who is an ACI certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mix concrete products that complies with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency for Mix Design Qualifications: An independent agency, registered in the Commonwealth of Massachusetts as an approved testing agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade 1. The Testing Agency Laboratory supervisor shall be an ACI certified Concrete Laboratory Testing Technician – Grade II.

D. Source Limitations: Obtain each type of class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications:

1. Comply with the following unless modified by requirements in the Contract Documents:
   a. ACI 117, “Standard Specifications for Tolerances for Concrete Construction and Materials.”
   b. ACI 211.1, “Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete.”
   c. ACI 214, “Evaluation of Strength Test Results of Concrete.”
   d. ACI 301, “Specification for Structural Concrete.”
   e. ACI 304, “Guide for Measuring, Mixing, Transporting and Placing Concrete.”
   f. ACI 305, “Hot Weather Concreting.”
   g. ACI 306, “Cold Weather Concreting.”
   h. ACI 308, “Guide to Curing Concrete.”
   i. ACI 309, “Guide for Consolidation of Concrete.”
   j. ACI 311.1, “ACI Manual of Concrete Inspection.”
   k. ACI 315, “Details and Detailing of Concrete Reinforcement.”
   l. ACI 318, “Building Code Requirements for Structural Concrete and Commentary.”
   m. ACI 347, “Guide for Formwork for Concrete.”
2. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract.

F. American Society for Testing and Materials (ASTM):

1. ASTM C309 "Liquid Membrane-Forming Compounds for Curing Concrete."
2. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
3. ASTM C979 "Standard Specification for Pigments for Integrally Colored Concrete."

G. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M194 "Chemical Admixtures."

H. Pre-installation Conference: Conduct a conference at the Project site to comply with requirements in Division 1 Section “Project Management and Coordination.”

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend including the following:
    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete subcontractor.
    e. Structural Engineer.
    f. Independent testing agency responsible for field testing.
    g. Owner's Authorized Representative.
    h. Engineer.
2. Review inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint filler strips, semi-rigid joint fillers, forms and form removal limitations, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor slab and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS:

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide

units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, ¾-inch by ¾-inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral earth pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

G. Furnish units that will leave no corrodible metal closer than 1-inch to the plane of exposed concrete surface.

H. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT:

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 NON-METALLIC SHRINKAGE RESISTANT GROUT:

A. Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. The minimum ultimate compressive strength of the grout shall be 5000 psi at 7 days and 7500 psi at 28 days.

2.04 REINFORCEMENT ACCESSORIES:

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolster, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice", of greater of compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless steel bar supports.
2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Concrete bricks may be used to support reinforcing steel where application allows.

2.05 CONCRETE MATERIALS:

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout the Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:

B. Fly Ash: ASTM C 618, Class C or F.

C. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.

D. Cementitious Materials: Percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash or Ground Granulated Blast Furnace Slag: 25 percent, minimum.
2. Combined Fly Ash and Pozzolan: 35 percent, maximum.
3. Ground Granulated Blast Furnace Slag: 50 percent, maximum.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 35 percent.

E. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse Aggregate Size: ¾-inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

F. Water: ASTM C 94 and potable.

2.06 ADMIXTURES:

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor,; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.

1. Products:
2. Euclid Chemical Company; Eucon CIA.
3. Grace Construction Products, W.R. Grace & Co.; DCI.
4. BASF Admixtures, Inc.; Rheocrete CNI.
5. Sika Corporation; Sika CNI.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products:
   a. Grace Construction Products, W.R. Grace & Co.; DCI-S.

2.07 WATERSTOPS:

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, ¾-inch by 1-inch.

1. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
2. Concrete Sealants, Inc.; Conseal CS-231.
3. Greenstreak; Swellstop.
4. Henry Company, Sealants Division; Hydro-Flex.

5. Progress Unlimited, Inc.; Superstop.
6. TCMiraDRI; Mirastop.

B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8-inch by ¾-inch.

1. Deneef Construction Chemicals; Swellseal.
2. Greenstreak; Hydrotite.
3. Mitsubishi International Corporation; Adeka Ultra Seal.
4. Progress Unlimited, Inc.; Superstop.

C. Waterstops: Provide ribbed, dumbbell type or center bulb type waterstops at construction joints and other joints as indicated.

1. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

2.08 VAPOR RETARDERS:

A. Plastic Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products:
   a. Fortifiber Corporation; Moistop Ultra.
   b. Raven Industries, Inc.; Vapor Block 10.
   c. Stego Industries, LLC; Stego Wrap, 15 mils.

2.09 FLOOR AND SLAB TREATMENTS:

A. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of Portland cement, graded quartz aggregate, and plasticizing admixture.

1. Products:
   a. Burke by Edoco; NonMetallic Floor Hardener.
   b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Conshake 500.
   c. Dayton Superior Corporation; Quartz Tuff.
   d. Euclid Chemical Company; Surflex.
   e. Lambert Corporation; Colorhard.
   f. L&M Construction Chemicals, Inc.; Quartzpalte FF.
   g. Scofield, L.M. Company; Lithochrome Color Hardener.

h. Symons Corporation, a Dayton Superior Company; Hard Top.

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products:
   a. Burke by Edoco; Titan Hard.
   b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
   c. Curecrete Distribution Inc.; Ashford Formula.
   d. Dayton Superior Corporation; Day-Chem Sure Hard.
   e. Euclid Chemical Company; Euco Diamond Hard.
   f. Kaufman Products, Inc.; SureHard.
   g. L&M Construction Chemicals, Inc.; Seal Hard.
   h. Meadows, W.R., Inc.; Liqui-Hard.
   i. Symons Corporation, a Dayton Superior Company; Buff Hard.

2.10 CURING MATERIALS:

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. /sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor coverings.

1. Products:
   a. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
   b. Dayton Superior Corporation; Safe Cure and Seal (J-19).
   c. Euclid Chemical Company; Diamond Clear VOX.
   d. Lambert Corporation; Glazecote Sealer-20.
   e. L&M Construction Chemicals, Inc.; Dress & Seal WB.
   f. Meadows, W.R., Inc.; Vocomp-20.
   g. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.

h. Sonneborn, Div. Of ChemRex; Kure-N-Seal.

i. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products:

a. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.

b. Euclid Chemical Company; Super Diamond Clear VOX.

c. Lambert Corporation; UV Safe Seal.

d. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.

e. Meadows, W.R., Inc.; Vocomp-30.

f. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.

2.11 RELATED MATERIALS:

A. Expansion and Isolation Joint Filler Strips: ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336-inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 CONCRETE MIXTURES, GENERAL:

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water cementitious materials ratio below 0.50.
4. Use retarding admixture in combination with Set accelerating Corrosion Inhibitor. Retarder is not required for non-set accelerating corrosion inhibitor.
5. Use corrosion inhibiting admixture in concrete mixtures where indicated.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS:

A. Footings and Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.

3. Slump Limit: 4-inches for concrete with verified slump of 2-inch to 4-inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1-inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Exterior slabs-on-grade and sidewalks: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.40.
3. Slump Limit: 4-inches for concrete with verified slump of 2-inch to 4-inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1-inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size
5. Corrosion Inhibiting Admixture: Apply to all slabs at a rate of 4 gallons per cubic yard of concrete.

2.14 FABRICATING REINFORCEMENT:

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice".

2.15 CONCRETE MIXING:

A. Ready-Mix Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94, and furnish batch ticket information.

B. When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 GENERAL:

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing.

3.02 FORMWORK:

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8-inch for smooth-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspections ports where interior area formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.03 EMBEDDED ITEMS:

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges".
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting type screeds.

3.04 REMOVING AND REUSING FORMS:

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form removal operations and curing and protection operations are maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by the Engineer.

3.05 VAPOR RETARDERS:

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

B. Lap joints 6-inches and seal with manufacturer's recommended tape.

3.06 STEEL REINFORCEMENT:

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire ties.

3.07 JOINTS:

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or approved by the Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2-inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at the underside of floors, slabs, beams, and girders and at the top of footings and floor slabs.
5. Space vertical joints in walls at 60-feet on center maximum. Locate joints besides piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge joint to a radius of 1/8-inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Terminate full-width joint filler strips not less than ½-inch or more than 1-inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants", are indicated.
2. Install joint filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.08 CONCRETE PLACEMENT:

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed

continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6-inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in continuous operation, within limits of construction joints, until placement of panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 degrees F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, providing water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing of concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.09 FINISHING FORMED SURFACES:

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with minimum number of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS:

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straightening until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 for a randomly trafficked floor surface:
3. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

D. Broom Finish: Apply a broom finish to exterior platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.11 MISCELLANEOUS CONCRETE ITEMS:

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTING AND CURING:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Curing all slabs in the project with moisture curing. Keep surfaces continually moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in the widest practicable width, with sides and ends lapped at least 12-inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subject to heavy rainfall within three hours after initial applications. Maintain continuity of coating and repair damage during curing period.
   a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subject to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply second coat. Maintain continuity of coating and repair damage during curing period.

D. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

3.13 JOINT FILLING:

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.14 CONCRETE SURFACE REPAIRS:

A. Defective Concrete: repair and patch defective areas when approved by the Engineer. Remove and replace concrete that cannot be repaired and patched to the Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½-inch in any dimension in solid concrete, but not less than 1-inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush coat holes and voids with bonding agent. Fill and compact patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, pop outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14-days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Repair defective areas, except random cracks and single holes 1-inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least ¾-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1-inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72-hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to the Engineer's approval.

3.15 FIELD QUALITY CONTROL:

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample of each day's pour of each concrete mixture exceeding 5 cubic yards, but less than 25 cubic yards, plus one set for each additional 50 cubic yards or fraction thereof.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 degrees F and below and when 80 degrees F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31.
6. Cast and laboratory cure five standard cylinder specimens for each composite sample.
7. Compressive Strength Tests: ASTM C 39; test one set of two-laboratory-cured specimens at 7 days and one set of two specimens at 28 days. Test remaining specimen at 28 days if previous results are satisfactory or retain this specimen for 56 day testing if results are not satisfactory.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive strength tests equals or exceeds

specified compressive strength and no compressive strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to the Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7 and 28 day tests.

1. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as the sole basis for approval or rejection of concrete.
2. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as required by the Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as required by the Engineer.
3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
4. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

3.16 GROUTING:

A. Mix grout in accordance with the approved manufacturer's instructions to a consistency which will permit placement. Place grout so as to ensure complete bearing and elimination of air pockets.

END OF SECTION

SECTION 03320

REINFORCED CEMENT CONCRETE MOW STRIP

PART I - GENERAL

1.01 SCOPE OF WORK

The work to be done in this section shall be to construct a cast in place reinforced concrete mower strip as located and detailed in the plans and as specified herein. The Contractor shall furnish all labor, material, equipment and transportation necessary to accomplish this task.

1.02 REFERENCE STANDARDS

a. References herein to any technical society, organization, group of body are made in accordance with the following abbreviations.

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing Materials

b. "Massachusetts State Specifications" refers to the Standard Specifications for Highways and Bridges, l988 Edition and all supplements thereto, as published by the Commonwealth of Massachusetts, Department of Public Works.

PART II - MATERIALS

2.01 Gravel base shall conform to Section 02300 of these Specifications.

2.02 Forms, reinforcing steel and cement concrete cast-in-place shall conform to Section 03300 of these Specifications.

2.03 All fence posts shall be set into place in accordance with shop drawings and fencing layout; mower strip to be poured between post footings with tooled construction joints.

2.04 Cement Concrete shall conform to Section 03300 of these Specifications.

2.05 Preformed expansion joint filler shall be of a non-extruding and resilient non-bituminous type conforming to AASHTO-M135.

PART III- EXECUTION

3.01 Excavation shall conform to Section 02300 of these Specifications.

3.02 Placement and compaction of processed gravel shall conform to Section 02355 of these Specifications.

3.03 Placement of reinforcing steel shall conform to Section 03300 of these Specifications; coordinate with fencing sections; cast cement concrete against post footings and tool joints.

3.04 Placement and Finish of Cement Concrete: The concrete shall be placed in such quantity that after being thoroughly consolidated in place it shall be six (6) inches or twelve (12) inches in depth as designated on the plans and details. No finishing operation shall be performed until all bled water and water sheen has left the surface and the concrete has started to stiffen. After water sheen has disappeared, edging operations where required shall be completed. All tool marks shall be eliminated. After edging and jointing operations, the surface shall be floated with aluminum or magnesium floats. If necessary, tooled construction joints and edges shall be rerun to maintain uniformity.

3.05 Curing of cement concrete shall conform to Section 03300 of these Specifications.

END OF SECTION

SECTION 04050

FIELDSTONE MASONRY WALL AND PIERS

PART I – GENERAL

1.01 SCOPE OF WORK

a. Under this Section, the Contractor shall furnish all labor, materials, equipment and transportation required to construct the required fieldstone masonry wall and piers. The wall and piers are located at the entrances to the site and as detailed and specified elsewhere in the Contract Documents.

1.02 REFERENCE STANDARDS AND SPECIFICATIONS

a. Reference to the standards, specifications and tests of technical societies, organizations, and governmental bodies is made in the Contract Documents.

1. AASHTO - American Association of State Highway and Transportation Officials (tests or specifications).

2. ASTM - American Society for Testing and Materials.

3. Mass. Standard Specs. - Latest edition of the Standard Specifications for Highways, Bridges and Waterways, 1988 Edition, the Commonwealth of Massachusetts, Department of Public Works, (MassDOT) hereinafter referred to as "the MDPW Standard Specifications, "Section 685, as modified herein.

1.03 SHOP DRAWINGS AND SAMPLES

a. Samples of the stone are to show color, grain, and surface finishing and shall be submitted to the Engineer for approval. Complete erection drawings shall be prepared and furnished to the Engineer for approval prior to ordering, delivering, and construction of furnished materials for the walls.

PART II – MATERIALS

2.01 STONE

a. All stone shall be of granite, hard and durable, free from seams, which impairs structural integrity, and of smooth splitting character obtained from an approved quarry. Natural variations characteristic of the deposit will be permitted.

b. Stones shall be generally flat with dimensions that range from 4 inch x 8 inch in height to 4 inch x 12 inch in length. All surfaces to be sawn (as applicable) shall

have a maximum variation in their thickness of ± 1/4 inch. All other dimensions and surface finishes shall be as shown on the Drawings. An image below represents the basic finished appearance of the wall and piers.

c. The front face of all stones shall have no projections or depressions greater than 1/2 inch for the full length of the stone. Front faces of all stones shall have no visible split marks.

2.02 MORTAR

a. Mortar shall conform to MDPW Standard Specification M4.02.15, and shall be composed of one (1) part Portland cement conforming to ASTM C150 and two (2) parts sand for cement mortar with sufficient water for forming a workable mixture. Adjust color with light and dark cement to the satisfaction of the Engineer.

b. All mortar joints to be pointed shall be properly cleaned of any loose mortar and debris. Remove all salts, which may interfere with proper adherence.

2.03 FOOTINGS

a. The cement concrete for the footings shall be in conformance with Section 9.01 of these Specifications and all relevant details.

PART III - EXECUTION

3.01 The stone wall and piers shall be set with mortar joints in the exposed surfaces not exceeding 3/8 inch and shall be raked ¼ inch. Stones shall be supplied and placed generally so as to form a random pattern avoiding continuous joints horizontally or vertically.

3.02 Stone piers shall be constructed as shown on the drawings, with all joints raked to a depth of one-half (1/2) inch.

3.03 No excess mortar shall be permitted to remain on the piers or on-grade surfaces. Clean as necessary to the satisfaction of the Engineer.

PART IV - GUARANTEE

4.01 Guarantee all materials and workmanship for a period of one (1) year from date of final acceptance.

- - - END OF SECTION - - -

SECTION 05000

MISCELLANEOUS METALS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including the General and Supplementary Conditions and Division 0 – Bidding Documents, Contract Forms, and Conditions of the Contract and Division 1 – General Requirements, apply to the work of this Section.

B. Carefully examine all the Contract Documents for requirements which affect the work of this Section. The exact scope of this Section cannot be determined without a thorough review of all specification sections and other Contract Documents.

1.02 REFERENCES

A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 1, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.03 WORK INCLUDED

A. The work of this Section consists of all miscellaneous site metals and related items as indicated on the Drawings and/or as specified herein and includes, but is not limited to, the following:

1. Hand Railings

B. Under work of this Section provide color finish for material items furnished under SITE FURNISHINGS Section.

1.04 RELATED WORK UNDER OTHER SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Site Furnishings
2. Concrete

1.05 STANDARDS

A. The following standards including all current amendments form a part of these Specifications:

1. American Society for Testing and Materials (ASTM):

A36	Structural Steel
A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
A120	Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses
A307	Carbon Steel Externally and Internally Threaded Standard Fasteners
A325	High Strength Bolts for Structural Steel Joints
A500	Cold Formed Welded and Seamless Carbon Steel Structural Tubing Rounds and Shapes

2. American Welding Society (AWS):
   D1.1 Structural Welding Code

3. Steel Structures Painting Council (SSPC):
   SSPC Surface Preparation Specifications

1.06 SAMPLES AND SUBMITTALS

A. At least thirty days prior to intended use, the Contractor shall provide the following samples and submittals for approval in conformance with requirements this specification. Do not order materials until Landscape Architect's approval of samples, certifications or test results have been attained. Delivered materials shall closely match the approved samples.

1. Shop Drawings: Submit detailed shop drawings for each item required to be fabricated or installed under work of this Section. Include plans, sections, and details as required to show completely materials, layout, jointing, clearances and connections for all items required. Shop drawings for handrails at stairs and at other site conditions requiring accurate dimensional relationships to as-built construction shall be prepared following a review and confirmation of as-built measurements and conditions for areas scheduled to receive miscellaneous metal items. Submit shop drawings for the following:

   a. Handrails

2. Material Samples: Submit samples for each material for the following:

a. Railing tube material and finishes – submit one (1) sample
b. Sheet metal material and finishes – submit three (3) samples of finishes for brushed stainless steel per manufacturer's recommendation and Owner's direction.

3. Manufacturer's Literature: Submit three (3) copies each of manufacturer's material descriptions and installation instructions for the following:

a. Non-shrink cement grout,
b. Sealant.

4. Finishing Schedule: Submit a complete schedule outlining all items to be color finished under work of this Section together with a breakdown of surface preparation techniques and primer and color finish materials to be applied.

PART 2 - PRODUCTS

2.01 STEEL PIPE HANDRAILS

A. Steel pipe for straight sections and for pipe sleeves shall be schedule 40 circular seamless steel pipe in accordance with ASTM A120.

B. Steel pipe for all railings with curved sections shall be Schedule 40, circular, seamless steel pipe in accordance with ASTM A53 requirements. Curves shall be formed to maintain uniform cross-section of pipe and to produce smooth and continuous alignments.

C. Square or rectangular steel tubing as required, shall conform to requirements for ASTM A500, Grade B, structural steel tubing. Wall thickness shall be one-eighth inch (1/8") or as detailed.

D. Steel hardware for designated structural purposes shall conform to ASTM A325 requirements for galvanized hardware.

E. Handrail, guardrail, and tubular steel pipe size shall be one and one-half inches (1.5") O.D. unless designated otherwise on the details.

F. Fabrication: Steel railings shall be fabricated in accordance with details, specifications and approved shop drawings. Steel fabrication shall be accomplished using the highest standards of workmanship. Individual steel pieces shall be saw-cut, formed with "fish-mouth" joints, and shall be full seam welded, ground smooth and sanded to produce a high standard of surface smoothness. No grinding marks shall be visible in the finished work.

G. Welding shall be in conformance to AWS code.

H. Following fabrication, pipe rails shall be painted in accordance with metal finishing in Section 09900 PAINTING.

I. Cement grout for anchoring of railings shall be a pourable, quick-setting, non-metallic and non-shrinking hydraulic cement grout equal to "Por-Rok Cement" supplied by Waldo Bros., Roslindale, MA, "Rockite" as manufactured by Hartline Co., Cleveland, OH, "Wedj-Rok" as manufactured by Metalcrete Manufacturing Co., Cleveland, OH, or approved equal.

J. Sealants shall be polyurethane-based, one component, elastomeric sealants complying with Fed. Spec. TT-S-00230C, Class A, Type 2. Color to be selected by Landscape Architect. Sealants shall be non-sag, gun-grade type, equal to the following:

a. Vulkem 116, as manufactured by Mameko International, Cleveland, OH.

b. Sikaflex 1-a, as manufactured by Sika Corp., East Hartford, CT.

c. Dynatrol 1, as manufactured by Pecora Corporation and supplied by Waldo Brothers, Boston, MA.

K. Poured-in-place concrete footings, where required, shall conform to requirements for twenty-eight (28) day compressive strength 3,000 psi, three-quarter inch (3/4") aggregate concrete, in accordance with requirements of Section 03300, CAST-IN-PLACE CONCRETE.

L. FINISHES shall be as follows: Cold galvanizing compound shall be a single component zinc rich compound yielding a dry film of at least 85% pure zinc. Galvanizing compound shall meet or exceed the requirements of Federal Specification MIL-P-21035, TT-P-641d primer for zinc rich compounds. Finish color coating shall be Color Galvanized Silver as provided by Duncan Galvanizing, Inc., or approved equal.

2.02 CAST ALUMINUM PARK SIGN

A. Cast aluminum park sign shall be 1” thick cast aluminum constructed with integral mounting pins at the dimensions shown on the drawings. Raised lettering and ½” border shall have brushed satin finish. Inset background shall be smooth black finish. Submit final shop drawing, indicating size font, letter size, letter spacing and finishes to the Owner’s representative for approval prior to fabrication.

2.03 ANCHORING CEMENT

A. Cement for anchoring posts in sleeves embedded in concrete walls or walkway haunches shall be "SUPER POR-ROK", as manufactured by Hallemite (Lehn and Fink Industrial Products Division of Sterling Drugs, Inc.), Montvale, New Jersey, or approved equal.

2.04 MISCELLANEOUS HARDWARE

A. Steel dowels for anchoring or aligning concrete and granite work described under Other Sections shall be fabricated of AISI Type 304 stainless steel, meeting requirements of ASTM A276.

B. Miscellaneous stainless steel hardware as required for the project shall be 18-8 stainless steel (AISI Type 304).

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C. Bolts: 3/8" Dia. SS Kwik Bolt II Expansion Anchor – Countersunk Version by HILTI Inc., PO Box 21148, Tulsa, OK, 74121

PART 3 - EXECUTION

3.01 STEEL PIPE HANDRAILS

A Fabrication of rail sections shall be in strict conformance with the approved shop drawings.

B All welding shall conform to the requirements of structural welding code AWDS1-1-79.

C. All welds shall be ground smooth, and all sharp edges, burrs, and other potentially hazardous irregularities shall be ground smooth and otherwise removed prior to cold galvanizing

3.02 RAIL ERECTION

A. Post sleeves, in the appropriate sizes, as shown on the drawings shall have been placed during the construction of the stairs in accordance with the details shown on the drawings and the pertinent provisions of Section 9.01 of these specifications.

B. After the ramp and stairs have sufficiently set and cured, as determined by the Engineer, the handrail posts shall be positioned in the sleeves and temporarily wedged in place so that the handrail is vertically plumb and horizontally straight for its complete length.

C. After the handrail has been satisfactorily positioned, the sleeves shall be filled with the approved anchoring cement with care taken not to create voids between

the post and sleeves nor spill excess cement on adjacent concrete. The fence shall be braced in position until the cement has properly set. Any movement caused by the Contractor's negligence shall be remedied as directed by the Engineer.

3.03 TOUCH-UP OF SURFACES

A. After erection, all scratches or abrasions in the color galvanized surface shall be repaired or replaced to the satisfaction of the Engineer.

B. Fabricate and install steel pipe handrails in conformance to details, and approved shop drawings. Measure on-site conditions to receive rails prior to preparing shop drawings.

C. For railings longer than twenty feet (20'), provide an internal sleeved expansion coupling joint at approximately fifteen foot on center (15' o.c.) intervals, using a six inch (6") length of internally sleeved pipe welded to one side of joint.

D. At stairways and at other locations as directed, install railings within cored holes. Grout rails to within one-half inch (1/2") of top surface and provide a sealant joint to finished grade. Sealant color to be approved by Landscape Architect.

3.05 MISCELLANEOUS HARDWARE

A. Furnish dowels and other miscellaneous hardware items for work of other Sections as specified and/or as required on the Drawings.

B. All anchoring systems employed shall be vandal-proof.

END OF SECTION

SECTION 13282

LEAD BASED COATINGS REMOVAL

PART 1 - GENERAL:

1.01 DESCRIPTION:

A. This Section specifies demolition of structures involving lead paint and lead-containing dust/debris at the concrete structure containing restrooms and a concession stand.

B. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Divisions One through Thirteen of these Specifications.

C. Examine all Drawings and all other Sections of the Specifications for requirements of related sections affecting the work of this Section. A lead determination of the Site buildings indicates that various painted components are considered to be lead-containing.

D. The work of this Section shall be performed as stated herein. In performing the work of this Section, the Contractor shall refer to other Sections for additional procedures. The Contractor is responsible for the coordination of the work of this Section with related work. No delays in completion of the work may be claimed for lack of coordination.

E. Contractor shall comply with all applicable local, state, and federal guidelines and regulations regarding all work involving the presence of lead-containing paint.

F. The work of this Section references work of the Contractor performing the demolition. Additionally, requirements of the Contractor regarding coordination and related work are identified in this Section and shall be considered the responsibility of the Contractor.

1.02 DESCRIPTION OF WORK:

A. The work of this Section includes full building demolition. The procedures described herein apply to all demolition work where a worker may be occupationally exposed to lead as well as to the disposal of the demolition debris. The Contractor shall assume that any painted surface not tested under this specification shall be assumed to contain lead paint and it shall be the Contractor's responsibility to protect workers performing under this Contract. This may require additional testing by the Contractor to verify lead content.

B. The Contractor shall assume full responsibility and liability for the compliance with all applicable Federal, State and local regulations pertaining to work practices, hauling and disposal of hazardous waste, protection of workers and visitors to the site, and persons occupying areas adjacent to the site. The Contractor shall hold the Engineer and Owner

harmless for failure to comply with any applicable work, hauling, disposal, safety, health or regulation on the part of himself, his workers or his subcontractors.

C. The Contractor is required to ensure the protection of workers performing any related demolition work that will affect surfaces coated with lead containing paint, lead-containing dust, as well as, protecting the public and the environment from exposure to lead dust.

D. The Contractor shall perform a general wash-down and cleaning of the interior of the Site building to remove loose and flaking paint as specified herein. The Contractor shall also perform lead waste characterization as specified herein.

E. CODES AND STANDARDS:

1. All work shall conform to the standards set by applicable Federal, State and local laws, regulations, ordinances, and guidelines in such form in which they exist at the time of the work on the contract and as may be required by subsequent regulations.

2. In addition to any detailed requirements of the Specification, the Contractor shall at his own cost and expense comply with all laws, ordinances, rules and regulations of Federal, State, Regional and Local Authorities regarding handling and storing of lead waste material.

3. The following references are cited as applicable standard and regulations as amended:

a. Code of Federal Regulations (CFR) Publications:

29 CFR 1910	General Industry
29 CFR 1926.55	Gases, Vapors, Fumes, Dusts and Mists
29 CFR 1926.57	Ventilation
29 CFR 1926.62	Lead in Construction
29 CFR 1926.200	Signs, Signals and Barricades
29 CFR 1926.354	Welding, Cutting and Heating in Way of Preservative Coatings
29 CFR Subpart T	Demolition
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards for Lead
40 CFR 61 Subpart A	General Provisions

40 CFR 61.152	Standard for Waste Manufacturing, Demolition, Renovation, Spraying, and Fabricating Operations.
40 CFR 241	Guidelines for the Land Disposal of Solid Wastes
40 CFR 257	Criteria for Classification of Solid Waste
40 CFR 261 and 262	Waste Disposal Facilities and Practices

b. Massachusetts Regulations:

454 CMR 23.00	Occupational Lead Exposure

c. American National Standards Institute (ANSI) Publications:

29.2-79	Fundamentals Governing the Design and Operation of Local Exhaust Systems
288.2-80	Practices for Respiratory Protection

d. National Institute of Occupational Safety and Health (NIOSH) Publications:

Manual of Analytical Methods, 4th Ed.

e. Underwriters Laboratories, Inc. (UL) Fire Resistance Directory Publications:

586-77 (R 1982)	Test Performance of High Efficiency Particulate, Air Filter Units

F. All regulations by the above and other governing agencies in their most current version are applicable throughout this project. Where there is a conflict between this Specification and the cited State, Federal, or local regulations, the more restrictive or stringent requirements shall prevail.

THIS SECTION REFERS TO MANY REQUIREMENTS FOUND IN THESE REFERENCES, BUT IN NO WAY IS IT INTENDED TO CITE OR REITERATE ALL PROVISIONS THEREIN OR ELSEWHERE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO KNOW, UNDERSTAND, AND ABIDE BY ALL SUCH REGULATIONS AND COMMON PRACTICES.

1.03 DEFINITIONS:

A. The following definitions apply to the performance of the work of this project.

1. Action Level: An airborne concentration of lead above 30 micrograms per cubic meter ($\mu g/m^3$) as a time weighted average (TWA) for more than 30 days per year.

2. Area Monitoring: Sampling of lead concentrations within the work area and outside the work area which is representative of the airborne concentrations of lead.

3. Clean Room: An uncontaminated change room directly adjacent to the work area having facilities for storage of employees' personal clothing and uncontaminated work clothes, materials and equipment provided when the airborne exposure to lead is above the PEL.

4. Contractor: The Contractor who is performing work involving lead containing paint under this Section.

5. Decontamination Area: A contained area adjacent to or connected to the abatement work area and consisting of an equipment room, shower area, and clean room which is used for decontamination of workers, materials and equipment.

6. HEPA Filter Equipment: High efficiency particulate air (HEPA) filtered vacuuming or exhaust ventilation equipment with a UL 586 filter system. Filters shall be of 99.97 percent efficiency for retaining 0.3 micrometer diameter particles.

7. Lead-Containing Paint: Paint, varnish, or stain, which contains lead in excess of 0.0% lead by weight.

8. Lead Permissible Exposure Limit (PEL): 50 $\mu g/m^3$ of air, based upon an 8-hour time weighted average.

9. Sample Location: Area or place where an air or wipe sample is collected.

10. Time Weighted Average (TWA): The TWA is an 8-hour time weighted average for the test of the concentration of lead for worker exposure.

11. Wet Cleaning: The process of removing lead contamination from building surfaces, equipment and other objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as lead contaminated wastes.

12. Work Area: A controlled-access work area, which has no plastic sheeting or other containment barriers, erected to separate the trades.

1.04 SUBMITTALS:

A. NOTIFICATIONS:

1. Provide in proper and timely fashion, all necessary notifications to relevant federal, state, and local authorities and obtain and comply with provisions of all permits or applications required by the work specified, as well as make all required submittals required under those auspices. Contractor shall indemnify the Owner and Engineer

from, and pay for all claims resulting from failure to adhere to these provisions. Costs for all permits, applications, and the like are to be assumed by Contractor. Required notifications include but are not limited to the following:

a. Massachusetts Department of Environmental Protection, Form AQ06 - Construction/Demolition Notification.

B. Provide four (4) copies of the following Submittals at least 4 weeks prior to commencement of the work of the contract:

1. Copies of all notifications, permits, applications, licenses and like documents required by Federal, State, or local regulations and this specification obtained or submitted in proper fashion,

2. Copies of written medical opinions for each employee who may be occupationally exposed to lead as required by 29 CFR 1926.62 (j)(3)(v),

3. Copies of supervisors' and workers' training certificates,

4. Record of successful respirator fit testing performed by a qualified individual within the previous 6 months for <u>each</u> employee to be used on this project with the employee's name and social security number with each record,

5. Employer's Lead Compliance Program as required by 29 CFR 1926.62, including proposed respiratory protection program and medical monitoring for all employees throughout all phases of the job, including make, model and NIOSH approval numbers of respirators to be used; worker orientation plan; written description of all proposed procedures, methods, or equipment to be utilized, including those that may differ from the Contract Specifications. In all instances, Contractor must comply with all applicable federal, state and local regulations.

6. Proposed number and type (i.e., hazardous waste or non-hazardous waste, open top, front loading, etc.) of dumpsters for waste, proposed location(s),

7. A list of all equipment to be used on site, by make and model,

8. Chain of Command of responsibility at work site including supervisors and competent person, their names, resumes and certificates of training and phone numbers,

9. List of total number of supervisors and workers intended to be assigned to the project, including name and lead awareness qualifications,

10. Material Safety Data Sheets on potentially hazardous materials to be used on the project,

11. Waste Disposal Plan which describes the waste stream and the disposal means (i.e. landfill, recycle, etc.) and includes the name, address, and ID number of the proposed hazardous waste hauler, waste transfer route, and proposed disposal reclamation or treatment facility,

12. Name and address of the proposed construction debris site,

13. Construction schedule including sequence of critical work.

No work on the project will be allowed to begin until the Pre-Construction Submittals as listed herein are accepted by the Engineer. Any delay caused by the Contractor's refusal to submit this documentation in a timely fashion does not constitute a claim for extra compensation or a time extension.

C. Submit the following to the Engineer as a Post-Construction submittal package:

1. Copies of waste manifests and receipts acknowledging disposal of all lead waste material from the project, showing delivery date, quantity, and appropriate signature of landfill's authorized representative,

2. DEP approval for all waste reduction techniques, if utilized,

3. A notarized copy of the daily list of workers and site entry-exit logbook,

4. All personnel monitoring results,

5. All TCLP testing results.

1.05 GENERAL WORK PROCEDURES:

A. Work shall be carried out in sequential phases. Inspection and approval of each phase by the Engineer shall be sought and gained before proceeding to the next phase and in accordance with the schedule approved. This shall include demolition requirements for work area clearance and work area release before other work. As a Contract requirement, any reasonable delay caused by this requirement will not constitute a basis for claim against the Owner or Engineer. Contractor must coordinate the work of this section with the work of all other trades.

B. At no time will the Owner permit storage of lead waste materials generated from demolition activities inside the Site building, and any storage of materials will be subject to the Owner's approval. Assure security of lead waste materials at all times.

1.06 SPECIAL CONSIDERATIONS:

A. TESTING REFERENCES:

1. Testing for lead paint has been performed on a representative number of painted components at the Whitmore Field Facility in Newton, Massachusetts using Atomic Absorption Spectrophotometry (AAS) analysis.

B. The Contractors shall follow the requirements of this Section regarding component removal, demolition, worker exposure and protection, work area cleaning, and waste disposal.

C. Work Affected – In general, the following activities are minimum requirements of this Section and affect the demolition performed on the painted components:

1. No torch cutting, mechanical sanding, stripping, or abrasive methods of paint removal shall occur.

2. No demolition activities may occur which increase the workers' exposure above the Action Level of 30 $\mu g/m^3$. Contractor shall fully complete with the OSHA lead standard at 29 CFR 1926.62.

3. Workers shall be informed of the components to be renovated or demolished that have been identified as containing lead.

4. Worker protection, at a minimum, shall comply with the OSHA Lead Standard 29 CFR 1926.62. Worker Right to Know and Health and Safety Standards of 1926.62 shall also apply to the work of this Section.

5. Separation of Trades: Unprotected, untrained workers or trades shall not perform any related work within the same vicinity as demolition-involving components identified with lead.

6. Clean-up Activities: The Contractor shall maintain work zones free of accumulated debris, lead dust, and paint chips.

C. Lead Contaminated Materials Clean-Up

1. Due to the presence of lead on representative painted surfaces, all loose and flaking paint at the Site buildings shall be removed from the substrate to which it is applied.

2. All debris with visible paint chips within the building, including, but not limited to piles of plastic, debris, plywood, blue tarps, etc. shall be considered lead contaminated.

3. The Contractor shall perform TCLP testing of the stored materials and properly package and dispose of these stored materials. In asbestos-contaminated areas, if

TCLP results are greater than 5.0 mg/L lead, the materials shall be disposed as a dual waste - ACM and lead hazardous waste. In asbestos-contaminated areas, if TCLP results are less than 5.0 mg/L, the materials shall be disposed as ACM waste.

4. At the completion of TCLP testing, and in conjunction with asbestos abatement activities under negative pressure containment as specified in Section 02051 - Asbestos Abatement of these specifications, the Contractor shall perform a wash-down of lead-contaminated dust and/or paint chips on the interior of the buildings. At the completion of the wash-down, no visible dust and debris shall remain within the buildings, tunnels or trenches.

1.08 FEES, PERMITS & LICENSES:

A. The Contractor shall pay all licensing fees, royalties, and other costs necessary for the use of any copyrighted or patented product, design, invention, or process in the performance of the work specified in this Section. The Contractor shall be solely responsible for costs, damages, or losses resulting from any infringement of these patent rights or copyrights. The Contractor shall hold the Engineer and Engineer harmless from any costs, damages, and losses resulting from any infringement of these patent rights or copyrights. If the Contract Specification requests the use of any product, design, invention, or process that requires a licensing, patent or royalty fee for use in the performance of the job, the Contractor shall be responsible for the fee or royalty fee and shall disclose the existence of such rights.

B. Contractor shall be responsible for costs for all licensing requirements, where applicable and notification requirements and all other fees related to the Contractor's ability to perform the work in this Section.

C. Secure all necessary permits for work under this Section, including hauling, removal, and disposal, fire, and materials usage, or any other permits required to perform the specified work.

1.09 CLEAN-UP:

A. Maintain the work site in a neat and orderly manner at all times, so as not to interrupt or infringe upon the work of other trades.

B. Comply with all requirements for release of work areas as described in the project specification.

C. It is the prerogative of the Engineer to inspect whenever deemed necessary, the Contractor is responsible for meeting, and correcting any deficiencies discovered which do not meet the current applicable regulations and requirements of these specifications.

1.10 COORDINATION:

A. At no time shall Contractor cause or allow to be caused conditions which may cause risk or hazard to the general public or conditions that might impair safe use of the facility. The use of the facility's electricity, water or like utilities by the Contractor shall be as specified in Division 1.

B. Coordinate the work of this Section with that of all other trades. Phasing and scheduling of this project will be subject to the approval of the Engineer. The work of this Section shall be scheduled and performed so as not to impede the progress of the project as a whole. Work shall not proceed in any area without the express consent of the Engineer. The Contractor shall be available within 24 hours notice for additional work if after acceptance of the work it is found that complete demolition was not achieved from the initial work effort as determined by the Engineer.

C. The proposed schedule for the work in this Section shall show the time involved from start to finish of demolition operations, including preparation, removal, clean-up, Engineer's inspections and de-mobilization portions of the job.

D. A final schedule shall then be prepared and coordinated with the Engineer and Engineer. The final scheduling shall be submitted in writing before the commencement of work.

E. Complete activities in the phases of the agreed upon final schedule. The work must be completed in a continuous, uninterrupted operation.

F. Unless specifically authorized by the Engineer, the work of this project shall be conducted according to the hours established in Division 1.

G. Inspections: The Engineer may perform visual inspections during the work of this section, as described below. Contractor shall not proceed with work until Contractor has received Engineer's approval at the stages identified below:

1. During: Before the commencement of a proposed alternative method other than specified.

2. Post Inspection: At the completion of work and final clean-up, before clearance or removal of any critical barriers and decontamination unit from the work area.

3. Waste Removal Inspection: Notify Engineer removal of hazardous waste from the site.

1.11 AUTHORITY TO STOP WORK:

A. The Engineer has the authority to stop the lead-based coatings removal and lead dust cleanup work at any time the Engineer determines that conditions are not within the Specifications and applicable regulations. The stoppage of work shall continue until conditions have been corrected and corrective steps have been taken to the satisfaction of the Engineer. Standby time required to resolve violations shall be at the Contractor's expense, and shall not be cause for extending the completion date.

1.12 EMERGENCY PRECAUTIONS:

A. The Contractor shall establish emergency and fire exits from the work area.

B. When an injury occurs, the Contractor shall stop work until the injured person has been removed from the work area.

1.13 DISPOSAL OF WASTE MATERIAL:

A. GENERAL:

1. Contractor and transporting Contractor will be required to comply with the Resource Conservation and Recovery Act (RCRA) and with all applicable federal, state, and local regulations.

2. Contractor shall be responsible for disposing of all waste determined by Toxicity Characteristic Leaching Procedure (TCLP) to be hazardous. If TCLP testing has not been performed, the Contractor shall be responsible for testing the waste.

3. Contractor and all sub-contractors shall comply with all EPA regulations.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. The Contractor shall deliver all materials and equipment to the site in the original containers bearing the name of the manufacturer, and details for proper storage and use.

B. All materials or equipment delivered to the site shall be unloaded, temporarily stored, and transferred to the work area in a manner that shall not interfere with other trades working in the area.

C. Unloading and temporary storage sites, and transfer routes, must be approved in advance by the Owner and Engineer.

D. Damaged or deteriorated materials may not be used and must be promptly removed from the premises. Material that becomes contaminated shall be packaged and legally disposed in an approved, secure landfill.

2.02 MATERIALS:

A. All materials and equipment proposed to be used on this project shall be subject to the acceptance of the Engineer. The list of required materials shall include, but not necessarily limited to the following:

1. Fire retardant polyethylene sheeting, minimum thickness of six (6)-mil.

2. Plastic bags, minimum thickness of six (6)-mil.

3. Duct Tape, up to 3 inch width

4. Lead Warning Signs, as required by the DOS Regulations and OSHA Hazard Communication requirements.

5. Flexible duct for ventilation units (if required)

6. Spray adhesive, fire retardant

7. Personal Protective Equipment, NIOSH approved respirators

8. Ventilation units with HEPA filtration and exhaust fans.

9. HEPA vacuums

10. Trisodium-Phosphate (TSP) and product data

11. Cloth tarpaulin

2.03 TOOLS AND EQUIPMENT:

A. Transportation Equipment: Transportation equipment, as required, shall be suitable for loading, temporary storage, transporting, an unloading waste without exposure to persons or property. All over-the-road transportation equipment must carry the appropriate hazardous waste transport licenses and insurance.

B. Vacuum Equipment: All vacuum equipment utilized in the work area shall utilize HEPA filtration systems.

C. Water Sprayer: The water sprayer shall be an airless or other low-pressure sprayer for water application.

D. Other Tools and Equipment: The Contractor shall provide other suitable tools including but not limited to: rounded edge shovels, rakes, brooms, and carts.

E. The Contractor shall provide ground fault circuit interrupters (GFCI) to protect all electrical cord and connections.

F. Approved lighting equipment for use in the work area.

G. Scaffolding: Scaffolding, as required to accomplish specified work, shall meet all applicable Federal, State and local safety regulations and used in accordance with manufacturer's specifications.

PART 3 – EXECUTION

3.01 SCHEDULING:

A. The Contractor shall coordinate all scheduling with the Engineer. A schedule of work shall be submitted to the Engineer before contract performance.

3.02 UTILITIES:

A. Provide all necessary connections for temporary utilities in the workplace during work. Shut down and disconnect all electrical power to the work area so that there is no possibility of reactivation and electrical shock during the work. The temporary electrical power shall be in accordance with all OSHA requirements.

3.03 IDENTIFICATION OF HAZARDS:

A. Prior to any work involving lead-containing items, the contractor shall identify all work activities in which a worker may be occupationally exposed to lead.

B. The Contractor shall initially determine if any worker may be exposed to lead above the action level.

3.04 BARRIERS AND ISOLATION AREAS:

A. All lead in demolition work areas shall remain isolated from all other trades on the project and remain inaccessible to the public. Contractor shall monitor the access to the demolition work areas. The below listed items are required to control the generation of lead-containing dust during demolition activities. The Contractor is ultimately responsible for cleaning all generated dust and paint debris from demolition operations and must maintain work areas free from lead dust generated from demolition activities.

1. Signs shall be posted at all approaches to the work area warning that work-involving lead is being conducted in the vicinity. Signs shall be in bold lettering not smaller than two inches tall.

2. Barriers shall not be removed until the work areas are thoroughly cleaned and approved by the Engineer.

3.05 APPROVALS AND INSPECTIONS:

A. All temporary facilities, work procedures, equipment, materials, services, and agreements must strictly adhere to and meet this Section along with EPA, OSHA, regulations and recommendations as well as federal, state, and local regulations. Where there exists overlap of these regulations, the most stringent one applies. All work performed by the Contractor is further subject to approval of the Engineer.

3.06 PERSONAL SAMPLING – CONTRACTOR:

A. Perform personal air sampling during all demolition work to determine worker exposure limits. The results of such sampling shall be posted, provided to individual workers, and submitted to Engineer as described herein.

B. Provide sampling to check personal exposure levels. Representative sampling shall be taken for the duration of the work shift or for eight hours, whichever is less. Personal samples need not be taken for repeated working conditions if working conditions remain unchanged, but must be taken every time there is a change in the removal operation, either in terms of the location or the type of work. Sampling will be used to determine eight-hour Time-Weighted-Averages (TWA). Personal sampling shall be as outlined in OSHA Standard 29 CFR 1926.62.

C. Air sampling results shall be transmitted to the Engineer and individual workers available at the job site in written form no more than forty-eight (48) hours after the completion of a sampling cycle. The reporting document shall list each sample's result, sampling time and date, personnel monitored and their social security numbers, flow rate, sample duration, sample yield, cassette size, and analyst's name and company, and shall include an interpretation of the results. Air sample analysis results will be reported in micrograms/cubic meter ($\mu g/m^3$).

D. The Contractor's testing lab shall be AIHA accredited for analysis of metals. Contractor shall submit for Engineer's review and acceptance the name and address of the laboratory, certification(s) of AIHA accreditation for metal analysis, listing of relevant experience in air lead analysis, and presentation of a documented Quality Assurance and Quality Control program.

E. Air monitoring frequency will be established in accordance with the requirements set forth in 29 CFR 1926.62.

3.07 WORK PROCEDURES:

A. The contractor shall initiate, and continue, sufficient engineering and work practice controls, as described in the Contractor's Lead Compliance Program, to reduce and maintain worker exposures to lead at or below the Action Level.

B. The following work practices are specifically required by these specifications:

1. All persons except those directly involved in the work shall be excluded from the work area. Physical barriers shall be used, where necessary, to limit access to the work area for the duration of the demolition operations. Warning signs may be posted in accordance with applicable regulations.

2. Provide hand-washing facilities and assure that all workers thoroughly wash their hands and face upon exiting the work area. Workers shall pay careful attention to cleanse the hands and face when decontaminating. Provide hygiene facilities, including shower, as required based on initial assessment and continued monitoring.

3. Thoroughly wet the building materials or areas to be demolished and mist the air to reduce the potential for creating airborne lead and dust.

4. All equipment used by the workers inside the work area shall be either left in the work area or thoroughly decontaminated before being removed from the area. Extra work clothing (in addition to the disposable suits supplied by the Contractor) shall be left in the clean area until the completion of work in that area. The clean area shall be cleaned of all visible debris and disposable materials daily.

5. Under no circumstances shall workers or supervisory personnel eat, drink, smoke, chew gum, or chew tobacco in the work area; to do so shall be grounds for the Engineer to stop all demolition operations. Only in the case of life threatening emergency shall workers or supervisory personnel be allowed to remove their protective respirators while in the work area. In this situation, respirators are to be removed for as short a duration as possible.

3.08 WORK PROCEDURES:

A. Feasible engineering controls shall be implemented by the Contractor as described in the Lead Compliance Program to minimize the possibility of contamination of areas adjacent to the work area. The following activities are the minimum requirements of this section and affect the demolition performed on the painted components:

1. No torch cutting, mechanical sanding, stripping, or abrasive methods of paint removal shall occur.

2. No demolition activities may occur which increase the workers exposure above the Action Level of 30 $\mu g/m^3$. Contractor shall fully comply with the OSHA lead standard 29 CFR 1926.62.

B. Workers shall be informed of the components to be renovated that are identified as containing lead.

C. Separation of Trades: Unprotected, untrained workers or trades shall not perform any related work within the same areas as demolition involving components identified as containing lead. Other trades may not enter these areas until clean-up procedures are completed.

3.09 STORAGE OF WASTE:

A. Use of waste containers on site shall be controlled under the following requirements:

1. Location of waste containers on site shall be subject to Owner's approval.

2. The waste containers lined shall be lined with two layers of six-mil polyethylene sheeting, be solid, enclosed containers, locked and sealed at all times. This requirement applies to waste classified as hazardous based on TCLP testing.

3. Contractor shall comply with all federal, state, and local regulations and ordinances regarding lead waste storage.

END OF SECTION

SECTION 16010

ELECTRICAL WORK - GENERAL PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The work covered by this section of the specifications consists of furnishing all labor, equipment, appliances, materials and incidentals in connection with the installation of the complete electrical systems as herein specified and as shown on the drawings.

B. It is not the intent that the drawings shall show every junction box, conduit, wire, fitting, device, accessory, etc., but the Contractor shall be required to furnish without additional expense all transportation, labor and materials necessary to complete the electrical systems in accordance with the best practice of the trade.

C. Unless otherwise specified, materials of the same classifications, used for the same purpose shall be the product of the same manufacturer.

D. The work shall include furnishing and installing the following items:

1. Underground Primary and Secondary Services
2. Grounding System
3. Panelboards
4. Raceways
5. Feeder and Branch Circuit Conductors
6. Solderless Lugs and Connectors
7. Conduit and wire for equipment and controls furnished under other divisions of the specifications, when shown on the electrical plans, with the exception of the instrumentation low voltage signal wiring.

E. Electric Service and Metering

The power company serving this project is Eversource.

1. Secondary conduit wiring and metering will be by the Contractor.

2. Arrangements shall be made with the power company for obtaining service. All cost for overhead line extensions and work required for these services including metering cost shall be obtained from the power company. The Contractor shall include in his bid and shall pay this money to the power company. All work involving the service and metering shall be as approved by the power company.

F. Interpretation of Drawings

1. The Drawings are diagrammatic only and are not intended to show exact locations of outlets and conduit runs.

2. All three-phase circuits shall be run in separate conduits unless otherwise shown on the Drawings.

3. The Contractor shall verify with the Engineer the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

4. Any work installed contrary to Contract Documents, or without approval by the Engineer, shall be changed or replaced as required by the Engineer and no extra compensation will be allowed the Contractor for making these changes.

5. The locations of equipment, fixtures, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. The Contractor shall obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, shall proceed as required by the Engineer and shall furnish all labor and materials necessary to complete the work in an approved manner.

6. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.

7. The number of conductors shown on the Drawings are not necessarily the correct number required. As many conductors as are required in each case shall be installed.

8. Unless otherwise specified, all conduits, wires, and cables and the support systems for the conduits and cables that are required to make the electrical connections to equipment shall be furnished and installed. All connections to equipment shall be made as shown, specified, and required and in accordance with the approved shop and setting drawings.

9. The Contractor shall verify, in the field, all measurements necessary for his work and shall assume responsibility for their accuracy.

1.02 LOCAL CONDITIONS:

A. Before submitting proposals, the Contractor is expected to inspect the site and survey the conditions to be encountered in the performance of the work. Failure to familiarize himself with the conditions shall not relieve the Contractor's responsibility for full completion of the work in accordance with the provisions of the Contract.

1.03 PERMITS AND INSPECTION:

A. Permits, fees and notices shall be in accordance with the General Conditions.

B. All work shall meet or exceed the latest requirements of all national, state, county, municipal and other authorities exercising jurisdiction over electrical construction at this project.

C. All required permit and inspection certificates shall be obtained, paid for, and given to the Owner at the completion of the work.

1.04 CODES AND STANDARDS:

A. Unless indicated or specified otherwise, materials and workmanship shall conform with the latest editions of the following codes, standards and specifications.

1. Massachusetts Electrical Code

2. National Bureau of Standards Handbook H-30 National Electrical Safety Code

3. State and Local Codes, and all other authorities having jurisdiction

4. Underwriter's Laboratories, Inc. (UL)

5. American National Standards Institute, Inc.

6. Institute of Electrical and Electronic Engineers (IEEE)

7. National Electrical Manufacturers Association (NEMA)

8. National Board of Fire Underwriters

9. International Municipal Signal Association (IMSA)

10. Insulated Power Cable Engineers Associated Specifications

11. American Society for Testing Materials Specifications

1.05 REVIEW OF MATERIALS:

A. Material and Equipment Schedules. As soon as practicable and within thirty days after the date of notice to proceed and before commencement of installation of any materials or equipment, the Contractor shall submit to the Engineer six (6) complete Brochures for approval of materials, fixtures, and equipment to be incorporated in the work. The list shall include manufacturer's name, catalog numbers, cuts, diagrams, drawings, and such other descriptive data as may be required. No consideration will be given to a partial submittal from time to time. Approval of materials will be based on manufacturer's published ratings. Any materials, fixtures and equipment listed that are not in accordance with the specification requirements will be rejected.

B. Substitutions: Substitution of material or equipment shall be in accordance with the General Conditions.

C. Shop Drawings. Shop drawings shall be submitted to the Engineer for review in accordance with the Division 1. Shop drawings shall be submitted for, but not limited to the following:

1. Panelboards

2. Wire and Cable

3. Hangers and Supports

4. Raceways

5. Cabinets

D. Submit the following information with all equipment shop drawings.

1. Manufacturer's certified scale drawings, cuts, or catalogs, including installation details and manufacturer's name.

2. Manufacturer's specifications, including certified performance characteristics and capacity ratings.

3. Electrical wiring diagrams and controls, where applicable.

4. Certificate of compliance with Code, where applicable.

5. Detail of all conduit stub-up with conduit size and dimensions from columns or walls.

E. Equipment shop drawings and wiring diagrams must be prepared specifically for this installation. Standard factory wiring diagrams with a revision marked in ink for this installation will be accepted.

F. All control and wiring diagrams shall be complete with the following description:

1. Sequence of operation

2. Sequence of interlocking

3. Operation of alarms

4. Legend

5. Wiring Numbers

G. All equipment shop drawings shall be properly identified and indicate the Article number of the specifications or the Drawing number which applies to the submitted item.

H. Shop drawings for the items listed above shall be submitted for approval in accordance with the preceding paragraphs. The Engineer, however, reserves the right to require submittal of shop drawings on any other material or equipment to be installed under this Section not specifically listed above.

1.06 MINOR DEVIATIONS:

A. The work as shown on the drawings is diagrammatic and is intended to show the work included and the arrangement of the various systems.

B. It is not intended that the accompanying plans and specifications cover every detail of the required installation. Furnish and install equipment, materials and labor as shown or specified, as are usually furnished, or as are needed to make a complete and satisfactory operating installation, whether mentioned or not, omitting only those items which are specifically excluded.

C. Locations and mounting heights of equipment and/or devices as shown are approximately correct. The Engineer reserves the right to relocate any equipment or device prior to actual installation at no extra cost to the Owner.

D. No deviation from layout shall be made without written approval from the Engineer.

1.07 TEMPORARY LIGHT AND POWER:

A. The Contractor shall provide temporary light and power and pay all energy charges as described in Division 1.

1.08 ELECTRICAL REFERENCE SYMBOLS:

A. Symbols shown on the drawings shall approximate location of fixtures, outlet boxes, and conduit runs, and other equipment, unless otherwise detailed. The exact location shall be governed by structural conditions and obstructions. This is not to be construed to permit redesigning systems. Locate and install all boxes and equipment where they will be readily accessible.

1.09 PHASE IDENTIFICATION:

A. The entire system of wiring shall be phased by color code as follows:

1. Wires No. 6 AWG and smaller shall have a continuous colored outer covering.

2. Wires larger than No. 6 AWG shall be identified at all points of termination by gummed tape, plastic tape, etc., applied to the wire.

3. Bus bars in panelboards shall be properly identified by color as herein specified.

4. Code colors for 277/480 volt systems shall be:

   a. Phase A – Black

   b. Phase B – Orange

   c. Phase C - Yellow

5. Code colors for 120/208 volt systems shall be:

   a. Phase A - Black

   b. Phase B - Red

   c. Phase C - Blue

6. Neutral wires shall be white or grey.

7. Equipment ground wires shall be green.

8. The same colors shall be used for the same phases throughout the entire project.

1.10 PROTECTION AND CLEANING OF EQUIPMENT:

A. All electrical equipment, upon receipt, shall be adequately stored and protected from damage.

B. After installation, all electrical equipment shall be protected to prevent damage during the construction period. Openings in conduits and boxes shall be closed to prevent entrance of foreign materials.

C. The interior of boxes and cabinets shall be left clean. Exposed surfaces shall be cleaned and plate surfaces polished.

1.11 OPERATION AND MAINTENANCE MANUALS:

A. The Contractor shall furnish the Owner with three (3) copies of complete operating and maintenance manuals. Manuals shall include all equipment, maintenance instruction, parts list, warranties, schematic diagrams of control systems, and lubrication charts.

B. Manuals shall contain only that information which specifically applies to this project, and all unrelated material shall be deleted. During the instruction period, herein specified, this manual shall be used and explained. Each copy of manual shall be clearly indexed and include a directory of all subcontractors and maintenance contractors, indicate the area of their responsibility, and list the name and telephone numbers of the responsible member of each organization. This material shall have a clear plastic protective shield over each sheet of data.

C. Each manual shall be bound in an expandable plastic covered hard bound binder. Binders shall be three post type. The manual's front cover and side cover shall be stamped "Operation and Maintenance Manual -- Electrical Systems" along with the project title.

1.12 OPERATING AND MAINTENANCE INSTRUCTIONS:

A. A competent Engineer shall be provided by the Contractor to instruct operating personnel in the operation and maintenance of equipment and systems.

1.13 SPARE PARTS DATA:

A. The Contractor shall furnish a complete list of recommended spare parts and supplies for the equipment furnished with current unit prices and source of supply.

1.14 TESTS:

A. The Electrical Subcontractor shall perform all tests at the completion of the work and the results furnished to the Owner and Engineer in writing. Tests shall include, but not be limited to: all systems test free of shorts or grounds, proper neutral connections, ground system resistance, secondary voltages at main distribution panel, power panels and lighting panels.

B. Upon completion of all work, the Electrical Subcontractor shall furnish, in duplicate, certificates of inspections from all inspectors and authorities having jurisdiction, notarized letters from the manufacturers stating that authorized Factory Engineers or agents have inspected and tested the installation of their respective systems and found same to be in satisfactory operating condition.

C. Furnish all labor, material, instruments, supplies and services and bear all costs for the accomplishment of the tests.

1.15 GUARANTEE:

A. The Contractor shall guarantee equipment and performance of the installation and equipment in accordance with the GENERAL CONDITIONS.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or manufacturer's specification shall be submitted for approval as required by the Engineer.

B. Materials and equipment used shall be U.L. listed wherever such approved materials and equipment is available.

C. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. If any apparatus has been damaged, such damage shall be repaired by the Contractor at his cost and expense. If any apparatus has been subject to possible damage by water, it shall be thoroughly dried out and put through such special tests as required by the Engineer, at the cost and expense of the Contractor, or shall be replaced by the Contractor at his own expense.

PART 3 EXECUTION

3.01 INSTALLATION

A. All work shall be executed in full accordance with the National Electrical Code and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, this Contractor shall bear full responsibility for such violations and assume all costs arising therefrom.

B. Load Balance. Check the load balance on the phases of the various systems and reconnect where necessary as approved by the Engineer to provide equal division of the loads between the phases of the various systems.

C. Before starting the work, confer with all other trades relative to the location of pipes, and apparatus or fixtures to be installed by them and select locations for the work which will avoid possible conflicts with the work of other trades involved. All differences or conflicting conditions concerning the work shall be called to the attention of the Engineer for adjustment before starting work. For such work performed or materials installed in violation of the above clause the work shall be readjusted to the complete satisfaction of the Engineer at the sole expense of the Electrical Subcontractor.

D. Cleanup

1. This Contractor shall cooperate with other workmen and with the General Contractor in the daily removal of debris from the work site.

2. This Contractor shall leave "broom clean" all areas where he has interrupted or completed his work.

3. He shall cooperate with the General Contractor in good housekeeping procedures.

4. At the completion of his work, prior to the final inspection, this Contractor shall clean all devices, plates, fixtures, glassware, switches, cabinets, exposed conduits, fittings, etc. and shall have the premises in a thoroughly clean condition.

END OF SECTION

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electricity-metering components.
6. Concrete equipment bases.
7. Cutting and patching for electrical construction.
8. Touchup painting.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: For electricity-metering equipment.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.06 COORDINATION

A. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.

B. Coordinate electrical service connections to components furnished by utility companies.

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

C. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 - PRODUCTS

2.01 RACEWAYS

A. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.

B. FMC: Zinc-coated steel.

C. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.

D. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.

E. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.

F. Raceway Fittings: Specifically designed for the raceway type with which used.

2.02 CONDUCTORS

A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.

B. Conductors, Larger Than No. 10 AWG: Stranded copper.

C. Insulation: Thermoplastic, rated at 75 deg C minimum.

D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.03 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

D. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

E. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

F. Expansion Anchors: Carbon-steel wedge or sleeve type.

G. Toggle Bolts: All-steel springhead type.

H. Powder-Driven Threaded Studs: Heat-treated steel.

2.04 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.

1. Type: Pre-tensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is over laminated with a clear, weather- and chemical-resistant coating.
3. Color: Black letters on orange background.
4. Legend: Indicates voltage.

C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.

D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend that indicates type of underground line.

E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.

H. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch, galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch grommets in corners for mounting.

I. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.05 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.

B. Meter Sockets: Comply with requirements of electrical power utility company.

2.06 CONCRETE BASES

A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."

B. Concrete: 3000-psi, 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."

2.07 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.01 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.02 RACEWAY APPLICATION

A. Use the following raceways for outdoor installations:

1. Underground, Single Run: RNC.
2. Underground, Grouped: RNC.
3. Connection to Vibrating Equipment: LFMC.
4. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Use the following raceways for indoor installations:

1. Damp or Wet Locations: IMC.
2. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

3.03 RACEWAY AND CABLE INSTALLATION

A. Use temporary raceway caps to prevent foreign matter from entering.

B. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

C. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.

D. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.

E. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

3.04 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

A. Feeders: Type THHN/THWN insulated conductors in raceway.

B. Underground Feeders and Branch Circuits: Type THWN or single-wire, Type UF insulated conductors in raceway.

C. Branch Circuits: Type THHN/THWN insulated conductors in raceway.

D. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.05 WIRING INSTALLATION

A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

B. Install wiring at outlets with at least 12 inches of slack conductor at each outlet.

C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.06 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.07 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

H. Simultaneously install vertical conductor supports with conductors.

I. Install metal channel racks for mounting cabinets, panelboards, control enclosures, pull and junction boxes, and other devices unless components are mounted directly to structural elements of adequate strength.

3.08 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Identify raceways and cables with color banding as follows:

1. Bands: Pre-tensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.

2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
3. Colors: As follows:
   a. Telecommunication System: Green and yellow.

E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Black.
2. Phase B: Red.
3. Phase C: Blue.

H. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

3.09 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.10 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.11 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electricity-metering components.
6. Concrete bases.
7. Cutting and patching for electrical construction.
8. Touchup painting.

B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.

1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
2. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
3. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
5. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

3.12 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.13 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 16123

CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 CONDUCTORS AND CABLES

A. Manufacturers:

1. Alcan Aluminum Corporation; Alcan Cable Div.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

C. Conductor Material: Copper, except feeders No. 4 AWG and larger may be aluminum complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

D. Conductor Insulation Types: Type THHN-THWN XHHW UF complying with NEMA WC 5 or 7.

E. Multiconductor Cable: Nonmetallic-sheathed cable, Type NM and Type USE with ground wire.

2.03 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.01 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type XHHW, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway

C. Exposed Branch Circuit: Type THHN-THWN, single conductors in raceway.

D. Underground Feeders and Branch Circuits: Type UF multiconductor cable.

3.02 INSTALLATION

A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

B. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

C. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."

D. Identify and color-code conductors and cables according to Division 16 Section Basic Electrical Materials and Methods.

3.03 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.04 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:

B. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

C. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 16130

RACEWAYS AND BOXES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 2 Section "Underground Ducts and Utility Structures" for exterior ductbanks, manholes, and underground utility construction.
2. Division 16 Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
3. Division 16 Section "Seismic Controls for Electrical Work" for seismic restraints and bracing of raceways, boxes, enclosures, and cabinets.
4. Division 16 Section "Wiring Devices" for devices installed in boxes.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. LFNC: Liquidtight flexible nonmetallic conduit.

G. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.

C. Shop Drawings: Signed and sealed by a qualified professional engineer.

1. Design Calculations: Calculate requirements for selecting seismic restraints.
2. Detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

D. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

E. Manufacturer Seismic Qualification Certification: Submit certification that enclosures, cabinets, accessories, and components will withstand seismic forces defined in Division 16 Section "Seismic Controls for Electrical Work." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 METAL CONDUIT AND TUBING

A. Manufacturer[**s**]:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Electri-Flex Co.
5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
6. LTV Steel Tubular Products Company.
7. Manhattan/CDT/Cole-Flex.
8. O-Z Gedney; Unit of General Signal.
9. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.

F. Plastic-Coated IMC and Fittings: NEMA RN 1.

G. EMT and Fittings: ANSI C80.3.

1. Fittings: Compression type.

H. FMC: Zinc-coated steel.

I. LFMC: Flexible steel conduit with PVC jacket.

J. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.03 NONMETALLIC CONDUIT AND TUBING

A. Manufacturer[**s**]:

1. American International.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corp.
4. Cantex Inc.
5. Certainteed Corp.; Pipe & Plastics Group.
6. Condux International.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; Division of Hubbell, Inc.
12. Spiralduct, Inc./AFC Cable Systems, Inc.
13. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.

D. ENT and RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

E. LFNC: UL 1660.

2.04 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.

1. Manufacturer[**s**]:

a. Airey-Thompson Sentinel Lighting; Wiremold Company (The).
b. Thomas & Betts Corporation.

c. Walker Systems, Inc.; Wiremold Company (The).
d. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC compound with matte texture and **manufacturer's standard** color.

1. Manufacturer[**s**]:

a. Butler Manufacturing Co.; Walker Division.
b. Enduro Composite Systems.
c. Hubbell, Inc.; Wiring Device Division.
d. Lamson & Sessions; Carlon Electrical Products.
e. Panduit Corp.
f. Walker Systems, Inc.; Wiremold Company (The).
g. Wiremold Company (The); Electrical Sales Division.

C. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.05 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturer[**s**]:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electric Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet-PLM Division.
10. Spring City Electrical Manufacturing Co.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.06 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

B. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid steel or IMC.
2. Concealed: Rigid steel or IMC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 4.

B. Minimum Raceway Size: 1/2-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

D. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

E. Do not install aluminum conduits embedded in or in contact with concrete.

3.02 INSTALLATION

A. Complete raceway installation before starting conductor installation.

B. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."

C. Install temporary closures to prevent foreign matter from entering raceways.

D. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

E. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

F. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

G. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors.

H. Tighten set screws of threadless fittings with suitable tools.

I. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase

nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

K. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

L. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

M. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

N. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

O. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.03 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.04 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION

SECTION 16442

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:

1. Lighting and appliance branch-circuit panelboards.

1.03 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

F. TVSS: Transient voltage surge suppressor.

1.04 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.

b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 16 Section "Seismic Controls for Electrical Work." Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. The term "withstand" means "the unit will remain in place without separation of internal and external parts during a seismic event."
3. The term "withstand" means "the unit will remain in place without separation of internal and external parts during a seismic event and the unit will be fully operational after the event."
4. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
5. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.

E. Field Test Reports: Submit written test reports and include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

G. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.06 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.07 EXTRA MATERIALS

A. Keys: Six spares of each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a. Eaton Corp.; Cutler-Hammer Products.
b. General Electric Co.; Electrical Distribution & Control Div.

c. Siemens Energy & Automation, Inc.
d. Square D Co.

2. TVSS Panelboards:

a. Current Technology, Inc.
b. Liebert Corporation.

2.02 FABRICATION AND FEATURES

A. Enclosures: Surface mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
1. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

C. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.

F. Bus: Hard-drawn copper, 98 percent conductivity.

G. Main and Neutral Lugs: Compression type suitable for use with conductor material.

H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

I. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

J. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

K. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

L. Gutter Barrier: Arrange to isolate individual panel sections.

M. Feed-through Lugs: Compression type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

2.03 PANELBOARD SHORT-CIRCUIT RATING

A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.

B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.05 OVERCURRENT PROTECTIVE DEVICES

C. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical or Compression style, suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [**55**] [**75**] percent of rated voltage.

2.06 ACCESSORY COMPONENTS ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: To test functions of solid-state trip devices without removal from panelboard.

C. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Division 16 Section "Seismic Controls for Electrical Work."

C. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

D. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

E. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

F. Install filler plates in unused spaces.

G. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.02 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section Basic Electrical Materials and Methods.

B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.03 CONNECTIONS

A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Testing Agency: Owner will engage a qualified independent testing agency to perform specified testing.

C. Testing Agency: Engage a qualified independent testing agency to perform specified testing.

D. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

E. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
4.

3.05 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.06 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 16526

EXTERIOR ATHLETIC LIGHTING

PART 1 – GENERAL

1.01 SUMMARY

A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.

B. The purpose of these specifications is to define the performance and design standards for Newton Highland Playground in Newton, Massachusetts. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications. Refer to Appendix : Sports Lighting Manufacturer Specifications and Details for additional information.

C. The sports lighting will be for the following venues:
   1. Baseball
   2. Football

D. The primary goals of this sports lighting project are:
   1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore light levels are guaranteed to not drop below specified target values for a period of 25 years. Life-cycle Cost: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated.
   2. Control and Monitoring: To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system including all costs to monitor for 25 years. Fields should be proactively monitored to detect fixture outages over a 25-year life cycle. All communication costs shall be included in the bid.

1. Environmental Light Control: It is the primary goal of this project to minimize spill light and glare to the players, spectators and adjoining properties.

1.02 LIGHTING PERFORMANCE

A. Performance Requirements: Playing surfaces shall be lit to an average target light level and uniformity as specified in the chart below. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below. Average illumination level shall be measured in accordance with the IESNA LM-5-04. Light levels shall be guaranteed not to drop below desired target values from the first 100 hours of operation for the maximum warranty period of 25 years or 10,000 hours.

B. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be 60’, see chart below. Higher

mounting heights may be required based on photometric report and ability to ensure the top of the beam angle is a minimum of 10 degrees below horizontal.

Pole ID	Mounting Height
A1, A2	60’
B1, B2, F1, F2, F3, F4	70’

C. Lighting Methodology: There are two methods that will be considered for calculation of the lighting designs for this project. The approved Lighting Method #1, automated timed power adjustments, as described in C.1 utilizes methodology that adjusts light levels through a series of programmed adjustments. The alternate Lighting Method #2, straight depreciation, as described in C.2 uses continuous lamp lumen depreciation which is recovered by relamping and cleaning lenses of the luminaires. Both methods must be at or above target light values throughout the 25 years of the contract/warranty provided by the manufacturer. Scans shall reflect initial design lumens, end of life design lumens, recoverable light loss factor (RLLF), and the Coefficient Utilization (CU) for the design. A +/- 10% design/testing allowance is not acceptable.

1. <u>Lighting Method #1: Automated Timed Power Adjustments:</u>

   a. The lighting system shall use automated timed power adjustments to achieve a lumen maintenance control strategy as described in the IESNA Lighting Handbook 10th Edition, Lighting Controls Section page 16-8: "Lumen maintenance involves adjusting lamp output over time to maintain constant light output as lamps age and dirt accumulation reduces luminaire output. With lumen maintenance control, either lamps are dimmed when new, or the lamp's current is increased as the system ages."
   b. Independent Test Report: If lamp replacement interval is greater than 3,000 hours, manufacturer shall supply an independent test report with applicable recoverable light loss factors. Manufacturers bidding an automated timed power adjustment system must provide an independent test report certifying the system meets the lumen maintenance control strategy above and verifying the field performance of the system for the duration of the useful life of the lamp based on lamp replacement hours. Report shall be signed by a licensed professional engineer with outdoor lighting experience. If report is not provided at least 10 days prior to bid opening, the manufacturer shall provide the initial and maintained designs called for in this specification under Lighting Method #2: Alternate Manufacturers, section 1.2.C.2.
   c. Project References: Manufacturers bidding any form of Automated Timed Power Adjustment light system must provide a minimum of 10 project references within the state of Massachusetts that have been completed within the last 12 months utilizing this exact technology. Manufacturer will include project name, project city, and if requested, contact name and contact phone number for each reference.

Area of Lighting	Average Target Light Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Baseball	50 footcandles infield 30 footcandles outfield	2.0:1.0 infield 2.5:1.0 outfield	25 infield 77 outfield	20’ x 20’
Football	50 footcandles	2.0:1.0	72	30’ x 30’

2. <u>Lighting Method #2 – Straight Depreciation</u>

   a. Light Level Requirements: Manufacturer shall provide computer models and guarantee target light levels on the field over 25 years. The specified maximum Recoverable Light Loss Factor of 0.65 and maintenance/group relamping schedule shall be provided in accordance with recommendations in the Leukos Abstract Volume 6, Number 3, January 2010, page 183-201: “Light Loss Factors for Sports Lighting”, and presented at the 2009 IESNA Annual Conference.

      For Lighting Method #2, scans for both initial and target light levels are required.

      1500w Fixture RLLF Requirements

Lamp Replacement Interval (hours)	Recoverable Light Loss Factor (RLLF)
3000	.65

   b. Based on anticipated hours of usage (300 hours per year), Option #2 systems would require a minimum of one (1) group lamp replacements over the 25 years. Data would reflect the actual RLLF adopted by the designer

Area of Lighting	Average Initial Light Levels	Average Target Light Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Baseball	76.9 footcandles infield 46.2 footcandles outfield	50 footcandles infield 30 footcandles outfield	2.0:1.0 infield 2.5:1.0 outfield	25 infield 77 outfield	20’ x 20’
Football	76.9 footcandles	50 footcandles	2.0:1.0	72	30’ x 30’

c. Revised Electrical Distribution: Manufacturer shall provide revised electrical distribution plans to include changes to service entrance, panel, and wire sizing if exceed specified design loads.

1.03 ENVIRONMENTAL LIGHT CONTROL

A. Spill Light Control: All fixtures shall utilize maximum spill light and glare control devices including, but not limited to, internal shields, louvers and external shields.

1.04 LIFE CYCLE ENERGY COSTS

25 Year Life Energy Cost: Manufacturer shall submit 25-year life energy cost calculations as follows. If lamp replacement interval is greater than 3000 hours, manufacturer shall supply an independent test report with applicable recoverable light loss factors.

Lamp replacement schedule per charts below:

			Lighting Method 1	Lighting Method 2
a.	Luminaire energy consumption _____ luminaires x 1.56 kW demand per luminaire x 0.19 kWh rate x 300 annual usage hours x 25 years			
b.	Demand charges, if applicable	+		
	TOTAL 25 -Year Life Energy Operating Cost	=		

Lighting Method 1 Lamp Replacement	Lighting Method 2 Lamp Replacement
5,000 hour intervals	3,000 hour intervals

PART 2 – PRODUCT

2.01 SPORTS LIGHTING SYSTEM CONSTRUCTION

A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, ballast and other enclosures shall be factory assembled, aimed, wired and tested.

B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All

wiring shall be enclosed within the crossarms, pole, or electrical components enclosure.

C. System Description: Lighting system shall consist of the following:
   1. Galvanized steel poles and crossarm assembly.
   2. Non-approved pole technology. Square static cast poles will not be accepted. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long term performance concerns.
   3. Pre-stressed concrete base embedded in concrete backfill allowed to cure for 12-24 hours before pole stress is applied. Alternate may be an anchor bolt foundation designed such that the steel pole and any exposed steel portion of the foundation is located a minimum of 18 inches above final grade. The concrete for anchor bolt foundations shall be allowed to cure for a minimum of 28 days before the pole stress is applied.
   4. All luminaires shall be constructed with a die-cast aluminum housing or external hail shroud to protect the luminaire reflector system.
   5. Manufacturer will remote all ballasts and supporting electrical equipment in aluminum enclosures mounted approximately 10' above grade. The enclosures shall be touch-safe and include ballast, capacitor and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Safety disconnect per circuit for each pole structure will be located in the enclosure. Integral ballast fixtures will not be accepted.
   6. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
   7. Controls and Monitoring Cabinet to provide on-off control and monitoring of the lighting system constructed of NEMA Type 4 aluminum. Communication method shall be provided by manufacturer. Cabinet shall contain custom configured contactor modules for 30, 60, and 100 amps, labeled to match field diagrams and electrical design. Manual Off-On-Auto selector switches shall be provided.
   8. Lightning Protection: Manufacturer shall provide integrated lightning grounding via concrete encased electrode grounding system as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A. If grounding is not integrated into the structure, the Manufacturer shall supply grounding electrodes, copper down conductors and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be not less than 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

D. Safety: All system components shall be UL listed for the appropriate application.

2.02 ELECTRICAL

A. Electric Power Requirements for the Sports Lighting Equipment:
   1. Electric power: 480 Volt, 3 Phase

2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.

B. Energy Consumption: The average kW consumption for the field lighting system shall be 61.8 kW for LED fixtures in Lighting Method 1. Lighting Method 2 kW will be defined in Life Cycle calculation chart (1.4) using a RLLF of .65.

C. Revised Electrical Distribution: Manufacturer shall provide, at their cost, revised electrical distribution plans to include changes to service entrance, panel, and wire sizing if using Lighting Method 2.

2.03 STRUCTURAL PARAMETERS

A. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, the minimum pole mounting heights from the playing field surface shall be as noted in Section 1.2.B. Higher mounting heights may be required based on photometric performance of manufacturer's luminaires to meet spill and glare requirements.

B. Support Structure Wind Load Strength: Poles and other support structures, brackets, arms, bases, anchorages and foundations shall be determined based on the IBC Building Code, wind speed of 105 MPH, exposure category C. Luminaire, visor, and crossarm shall withstand 150mph winds and maintain luminaire aiming alignment.

C. Structural Design: The stress analysis and safety factor of the poles shall conform to AASHTO, Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

D. Soil Conditions: The design criteria for these specifications are based on soil design parameters as outlined in the geotechnical report. If a geotechnical report is not provided by the owner, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by IBC.

It shall be the contractor's responsibility to notify the owner if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated. Contractor may issue a change order request / estimate for the owner's approval / payment for additional costs associated with:

1. Providing engineered foundation embedment design by a registered engineer in the State of Massachusetts.
2. Additional materials required to achieve alternate foundation.
3. Excavation and removal of materials other than normal soils, such as rock, caliche, etc.

E. Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole. These drawings must be submitted at time of bid to allow for accurate pricing.

2.04 CONTROLS AND MONITORING

A. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The manufacturer shall notify the owner of outages within 24 hours, or the next business day. The controller shall determine switch position (Manual or Auto) and contactor status (open or closed)

B. Remote Lighting Control System: System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.

   The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields, to only having permission to execute "early off" commands by phone.

   Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.

C. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of lamp outages, control operation and service scheduling including relamping operations completed and scheduled.

   Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.

   1. Cumulative hours: shall be tracked to show the total hours used by the facility
   2. Current lamp hours: shall be tracked separately to reflect the amount of hours on the current set of lamps being used, so relamping can be scheduled accurately.

D. Communication Costs: Manufacturer shall include communication costs for operating the controls and monitoring system for a period of 25 years.

PART 3 – EXECUTION

3.01 FIELD QUALITY CONTROL

A. Delivery Timing Equipment On-Site: The equipment must be on-site 4-6 weeks from receipt of approved submittals and receipt of complete order information.

B. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.

For Lighting Method 1, Timed Power Adjustment systems, light levels must be measured and exceed the specified target levels. For Lighting Method 2, light levels must be measured and meet the specified initial light levels.

C. Field Light Level Accountability
   1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warrantee period of 25 Years.
   2. The contractor/manufacturer shall be responsible for an additional inspection one year from the date of commissioning of the lighting system and will utilize the owner's light meter in the presence of the owner.
   3. The contractor/manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities. Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.

D. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including foot-candles, uniformity ratios, and maximum kilowatt consumptions are not in conformance with the requirements of the performance specifications and submitted information, the manufacturer shall be liable to any or all of the following:
   1. Manufacturer shall at his expense provide and install any necessary additional fixtures to meet the minimum lighting standards. The Manufacturer shall also either replace the existing poles to meet the new wind load (EPA) requirements or verify by certification by a licensed structural engineer that the existing poles will withstand the additional wind load.
   2. Manufacturer shall minimize the Owner's additional long term fixture maintenance and energy consumption costs created by the additional fixtures by reimbursing the Owner the amount of $1,000.00 (one thousand dollars) for each additional fixture required.
   3. Manufacturer shall remove the entire unacceptable lighting system and install a new lighting system to meet the specifications

3.02 <u>25 YEAR WARRANTY</u>

E. Each manufacturer shall supply a signed warranty covering the entire system for 25 years or for the maximum hours of coverage based on the estimated annual usage, whichever occurs first. Warranty shall guarantee that the average light levels will not fall below target levels; lamp replacements; system energy consumption; monitoring, maintenance and control services, spill light control, and structural integrity. Manufacturer shall maintain specifically funded financial reserves to assure fulfillment of the warranty for the full term. Warranty may exclude fuses, storm damage, vandalism, abuse and unauthorized repairs or alterations.

F. Preventative and Spot Maintenance: Manufacturer shall provide all preventative and spot maintenance, including parts and labor for 25 years from the date of equipment shipment. Individual lamp outages shall be repaired when the usage of any field is materially impacted. Owner agrees to check fuses in the event of a luminaire outage.

3.03 PRE-BID SUBMITTAL REQUIREMENTS

G. Approved Product: Musco's Green Generation Lighting® sports lighting system is the approved "Lighting Method 1" product. All submittal information at the end of this section must be submitted at least 10 days prior to bid for any alternates using Method #1 or any manufacture using Method #2. An addendum will be issued prior to bid, listing any approved alternate lighting manufacturers and the design method to be used.

H. Design Approval: The owner / engineer will review pre-bid submittals per section 3.3.A from all the manufacturers to ensure compliance to the specification. If the design meets the design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.

I. Bidders are required to bid only products that have been approved by this specification or addendum by the owner or owner's representative. Bids received that do not utilize an approved system/design, will be rejected.

REQUIRED SUBMITTAL INFORMATION ANY ALTERNATE MANUFACTURERS 10 DAYS PRIOR TO BID

All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements

Tab	Item	Description
A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
B	Equipment Layout	Drawing(s) showing field layouts with pole locations
C	On Field Lighting Design	Lighting design drawing(s) showing: a. Field Name, date, file number, prepared by b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, as well as luminaire information including wattage, lumens and optics d. Height of light test meter above field surface. e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), coefficient of utilization (CU) uniformity gradient; number of luminaries, total kilowatts, average tilt factor; light loss factor. f. Manufacturer's using Lighting Method 2 shall provide both initial and maintained light scans using a maximum Recoverable Light Loss Factor (RLLF) as specified in section 1.2.C.2
D	Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of Massachusetts, if required by owner. (May be supplied upon award).
E	Control & Monitoring System	Manufacturer of the control and monitoring system shall provide written definition and schematics for automated control system to include monitoring. They will also provide ten (10) references currently using proposed system in the state of Massachusetts.
F	Warranty	Provide written warranty information including all terms and conditions. Provide ten (10) references of customers currently under specified warranty in the state of Massachusetts.
G	Independent Testing Report	a. Lighting Method 1 is to provide an independent test report certifying the system meets the lumen maintenance control strategy defined in Section 1.2.C.1.a, verifying the field performance of the system for the duration of the useful life of the lamp based on lamp replacement hours. Report shall be signed by a licensed professional engineer with outdoor lighting experience. b. If Manufacturer using Lighting Method 2 desires to provide a recoverable light

		loss factor other than specified in section 1.2.C.2, Independent field test report from licensed professional engineer will be required to substantiate the ability to maintain light levels in accordance with section 1.7-A of the specification. Both initial and maintained light scans must still be provided. Independent Engineer conducting the report must have no affiliation with the manufacturer and report must be based on actual testing data. Testing must be done on the system as a whole, not on individual components.
H	Project References	Manufacturer to provide a list of 10projects where the technology and specific fixture proposed for this project has been installed in the state of Massachusetts. Reference list will include project name, project city, installation date, and if requested, contact name and contact phone number. Manufacturer bidding Lighting Method 2 must supply independent test report if lamp life relamping projection is greater than 3000 hours.
I	Product Information	Complete bill of material for all product being provided.
J	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications. If in full compliance, tab may be omitted.
K	Life-cycle Cost Calculation	Document life-cycle cost calculations as defined in the specification. Identify energy costs for operating the luminaires, maintenance cost for the system including spot lamp replacement, and group relamping costs. All costs should be based on 25 Years. (complete table below)

			Lighting Method 1	Lighting Method 2
a.	Luminaire energy consumption ____ luminaires x 1.56kW demand per luminaire x 0.19 kWh rate x # annual usage hours x 25 years			
b.	Demand charges, if applicable	+		
c.	Cost for spot relamping and maintenance over 25 years Assume 7.5 repairs at $500 each if not included with the bid	+		
d.	Cost to relamp all luminaires during 25 years # annual usage hours x 25 years / 3000 hours x $125 lamp & labor x fixtures if not included with the bid	+		
e.	Extra energy used without base bid automated control system $ Energy consumption in item a. x 10% if control system not included with the bid	+		
	TOTAL 25 -Year Life-cycle Operating Cost	=		

The information supplied herein shall be used for the purpose of complying with the specifications for Newton Highland Playground, Newton, Massachusetts. By signing below I agree that all re-

quirements of the specifications have been met and that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in the Non-Compliance section.

Manufacturer: _____ Signature: _____

Contact Name: _____ Date: _____/_____/_____

APPENDIX A

ORDER OF CONDITIONS

Setti D. Warren
Mayor

CITY OF NEWTON, MASSACHUSETTS
Department of Planning and Development

Telephone
(617)-796-1120
Telefax
(617) 796-1086
TDD/TTY
(617) 796-1089

September 4, 2015

Bob DeRubeis, Commissioner
Newton Parks and Rec. Dept.
246 Dudley Rd.
Newton, MA 02459

RE: Order of Conditions and Certificate of Understanding
Site: Newton Highlands Playground
DEP#: 239-738

Dear Mr. DeRubeis:

Enclosed please find the Order of Conditions (the Order) issued pursuant to the Wetlands Protection Act, General Laws, Ch. 131, Sec. 40 and pursuant to the Newton Floodplain/Watershed Protection Ordinance, Section 22-22, for the above-referenced project.

No work on the project may begin until the following requirements have been satisfied:

- ☐ You have read and understand the enclosed Order of Conditions (especially Newton's Findings and Special Conditions). It is the responsibility of the owner/applicant to ensure that all conditions and approved plans are complied with. Deviation from the approved plans or conditions may result in a stop work order or further enforcement, as well as the inability to obtain a Certificate of Compliance at project completion. Special Conditions include, but are not limited to:
  a. A pre-construction site visit must be scheduled with the Conservation office
  b. All aspects of the stormwater management system must be installed as per the plans. Any required or desired deviations from this plan shall be requested in writing of the Commission Office, who shall determine if said changes require filing a new Notice of Intent.
  c. The knotweed patch on the northern end of the culverted stream shall be aggressively controlled, and then mowed consistently in an effort to eradicate this population.
  d. To improve water quality in the adjacent wetlands and waterways, the use of herbicides and fertilizers shall be minimized and only slow-release, organic fertilizers shall be used (in conformance with City guidelines).

  21. Prohibited activities include: No new connections to the culverted stream are permitted under this Order of Conditions.
- ☐ You have signed and returned to me the attached Certificate of Understanding.
- ☐ The 10-business day appeal period had elapsed. The appeal period begins on the date of issue (pages 1 and 11 of the Order).
- ☐ You have had the original Order recorded at the Middlesex South Registry of Deeds and have forwarded proof of recording to the Conservation Commission (see Condition 9 of the Order). The Order is not valid until it is properly recorded.
- ☐ The DEP file number sign has been erected at the project entrance (see Condition 10 of the Order).
- ☐ You have contacted the Conservation office to arrange for a "pre-construction site visit" to inspect and approve erosion controls, to submit the name(s) and phone number(s) of the parties responsible for work on the site (e.g., contractor, erosion control monitors, field engineer, and wetland scientist), and to discuss other matters of construction as applicable.
- ☐ Please note that there may be other requirements in your Order of Conditions that must occur before work may be begin.

Upon completion of the project, you must submit:

- ☐ A "Request for a Certificate of Compliance" (state WPA Form 8a) and
- ☐ An engineer-stamped and signed "as-built plan" to the Conservation Commission stating that the work has been satisfactorily completed in compliance with the plans and the Order.

Once received, your Certificate of Compliance must be recorded at the Middlesex South Registry of Deeds and proof of recording sent to the Conservation office (as per the Wetlands Protection Regulations 310 CMR 10.05(9)(f)).

If you have any questions, please don't hesitate to contact the office at 617-796-1134. For the Commission,

Jennifer Steel, Sr. Environmental Planner

Enclosures: Order of Conditions
Certificate of Understanding
CC: Wetlands Division, DEP - NERO, 205B Lowell St., Wilmington, MA 01887

Conservation Commission
1000 Commonwealth Avenue, Newton, Massachusetts 02459
Email: jsteel@newtonma.gov

Setti D. Warren
Mayor

CITY OF NEWTON, MASSACHUSETTS
Department of Planning and Development

Telephone
(617)-796-1120
Telefax
(617) 796-1086
TDD/TTY
(617) 796-1089

Certificate of Understanding re
Conditions and Restrictions in Wetlands and Buffer Zones

Street Address: _____ DEP File # _____

Owner: _____ OOC Issue Date: _____

I, _____, one of the owners of _____, Newton, Massachusetts, do hereby acknowledge and understand that:

• A portion of my property lies within buffer zones and/or wetlands and that any **new work** within this area is subject to review and approval by the Conservation Commission,	*initials* _____
• I, as property owner, am **responsible for all work on my property** even if it is conducted by private contractors,	*initials* _____
• I have received and **read and understand all the conditions** established in the referenced Order of Conditions (OOC),	*initials* _____
• There are specific **requirements PRIOR to the start of work,**	*initials* _____
• There are specific **requirements DURING construction and work,**	*initials* _____
• There are specific requirements for **getting a Certificate of Compliance** once all work is complete, and	*initials* _____
• There are a number of **ongoing/perpetual conditions that restrict the kind of landscaping and maintenance activities** allowed within wetlands and/or buffer zones.	*initials* _____

I have carefully reviewed and understand all these requirements and agree to adhere to them.

_____ _____ _____
(Signature) (Printed Name) (Date)

Please complete this form and return it to:

Jennifer Steel
Conservation Commission
1000 Commonwealth Avenue, Newton, Massachusetts 02459
Email: jsteel@newtonma.gov

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
239-738
MassDEP File #

eDEP Transaction #

Newton
City/Town

A. General Information

Please note: this form has been modified with added space to accommodate the Registry of Deeds Requirements

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

1. From: Newton
Conservation Commission

2. This issuance is for (check one): a. ☒ Order of Conditions b. ☐ Amended Order of Conditions

3. To: Applicant:

Bob — a. First Name
DeRubeis — b. Last Name
City of Newton, Parks and Rec. Depa — c. Organization
246 Dudley Rd. — d. Mailing Address
Newton — e. City/Town
MA — f. State
02459 — g. Zip Code

4. Property Owner (if different from applicant):

a. First Name
b. Last Name
c. Organization
d. Mailing Address
e. City/Town
f. State
g. Zip Code

5. Project Location:

16 Winchester St. (@ Dedham St.) — a. Street Address
Newton — b. City/Town
83-3-25 — c. Assessors Map/Plat Number
d. Parcel/Lot Number

Latitude and Longitude, if known: d m s — d. Latitude; d m s — e. Longitude

A. General Information (cont.)

6. Property recorded at the Registry of Deeds for (attach additional information if more than one parcel):
   Middlesex
   a. County
   b. Certificate Number (if registered land)
   5856
   c. Book
   519
   d. Page

7. Dates: Aug. 18, 2015 (a. Date Notice of Intent Filed) Sept. 3, 2015 (b. Date Public Hearing Closed) Sept. 4, 2015 (c. Date of Issuance)

8. Final Approved Plans and Other Documents (attach additional plan or document references as needed):
   Plans for Newton Highlands Playground Rehabilitation (10 sheets plus cover).
   a. Plan Title
   Spurr (Weston and Sampson)
   b. Prepared By
   Bruce Adams
   c. Signed and Stamped by
   August 18, 2015, (revised August 28)
   d. Final Revision Date
   1" = 20'
   e. Scale
   f. Additional Plan or Document Title
   g. Date

B. Findings

1. Findings pursuant to the Massachusetts Wetlands Protection Act:

   Following the review of the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act (the Act). Check all that apply:

a. ☒ Public Water Supply
b. ☐ Land Containing Shellfish
c. ☒ Prevention of Pollution
d. ☒ Private Water Supply
e. ☒ Fisheries
f. ☒ Protection of Wildlife Habitat
g. ☒ Groundwater Supply
h. ☒ Storm Damage Prevention
i. ☒ Flood Control

2. This Commission hereby finds the project, as proposed, is: (check one of the following boxes)

Approved subject to:

a. ☒ the following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.

B. Findings (cont.)

Denied because:

b. ☐ the proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect the interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**

c. ☐ the information submitted by the applicant is not sufficient to describe the site, the work, or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the Act's interests, and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**

3. ☐ Buffer Zone Impacts: Shortest distance between limit of project disturbance and the wetland resource area specified in 310 CMR 10.02(1)(a) _____ a. linear feet

Inland Resource Area Impacts: Check all that apply below. (For Approvals Only)

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. ☐ Bank	a. linear feet	b. linear feet	c. linear feet	d. linear feet
5. ☐ Bordering Vegetated Wetland	a. square feet	b. square feet	c. square feet	d. square feet
6. ☒ Land Under Waterbodies and Waterways	0 a. square feet	0 b. square feet	c. square feet	d. square feet
	e. c/y dredged	f. c/y dredged		
7. ☐ Bordering Land Subject to Flooding	a. square feet	b. square feet	c. square feet	d. square feet
Cubic Feet Flood Storage	e. cubic feet	f. cubic feet	g. cubic feet	h. cubic feet
8. ☐ Isolated Land Subject to Flooding	a. square feet	b. square feet		
Cubic Feet Flood Storage	c. cubic feet	d. cubic feet	e. cubic feet	f. cubic feet
9. ☐ Riverfront Area	a. total sq. feet	b. total sq. feet		
Sq ft within 100 ft	c. square feet	d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	g. square feet	h. square feet	i. square feet	j. square feet

B. Findings (cont.)

Coastal Resource Area Impacts: Check all that apply below. (For Approvals Only)

	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
10. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below			
11. ☐ Land Under the Ocean	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
12. ☐ Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13. ☐ Coastal Beaches	a. square feet	b. square feet	c. cu yd nourishment	d. cu yd nourishment
14. ☐ Coastal Dunes	a. square feet	b. square feet	c. cu yd nourishment	d. cu yd nourishment
15. ☐ Coastal Banks	a. linear feet	b. linear feet		
16. ☐ Rocky Intertidal Shores	a. square feet	b. square feet		
17. ☐ Salt Marshes	a. square feet	b. square feet	c. square feet	d. square feet
18. ☐ Land Under Salt Ponds	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
19. ☐ Land Containing Shellfish	a. square feet	b. square feet	c. square feet	d. square feet
20. ☐ Fish Runs	Indicate size under Coastal Banks, Inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above			
	a. c/y dredged	b. c/y dredged		
21. ☐ Land Subject to Coastal Storm Flowage	a. square feet	b. square feet		
22. ☐ Riverfront Area	a. total sq. feet	b. total sq. feet		
Sq ft within 100 ft	c. square feet	d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	g. square feet	h. square feet	i. square feet	j. square feet

B. Findings (cont.)

* #23. If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.5.c (BVW) or B.17.c (Salt Marsh) above, please enter the additional amount here.

23. ☐ Restoration/Enhancement *:

a. square feet of BVW | b. square feet of salt marsh

24. ☐ Stream Crossing(s):

a. number of new stream crossings | b. number of replacement stream crossings

C. General Conditions Under Massachusetts Wetlands Protection Act

The following conditions are only applicable to Approved projects.

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:
   a. The work is a maintenance dredging project as provided for in the Act; or
   b. The time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.
   c. If the work is for a Test Project, this Order of Conditions shall be valid for no more than one year.
5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order. An Order of Conditions for a Test Project may be extended for one additional year only upon written application by the applicant, subject to the provisions of 310 CMR 10.05(11)(f).
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not extend the issuance date of the original Final Order of Conditions and the Order will expire on 9/4/18 unless extended in writing by the Department.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.

C. General Conditions Under Massachusetts Wetlands Protection Act

8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.

9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work.

10. A sign shall be displayed at the site not less then two square feet or more than three square feet in size bearing the words,

    "Massachusetts Department of Environmental Protection" [or, "MassDEP"]

    "File Number 239-738 "

11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before MassDEP.

12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.

13. The work shall conform to the plans and special conditions referenced in this order.

14. Any change to the plans identified in Condition #13 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.

15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.

16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.

18. All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.

19. The work associated with this Order (the "Project")
    (1) ☒ is subject to the Massachusetts Stormwater Standards
    (2) ☐ is NOT subject to the Massachusetts Stormwater Standards

    If the work is subject to the Stormwater Standards, then the project is subject to the following conditions:

    a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Construction General Permit as required by Stormwater Condition 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.

    b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that:
    i. all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures;
    ii. as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized;
    iii. any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10;

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

iv. all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition;

v. any vegetation associated with post-construction BMPs is suitably established to withstand erosion.

c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 18(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement) for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following:

i.) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and

ii.) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.

d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Multi-Sector General Permit.

e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 18(f) through 18(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 18(f) through 18(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.

f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.

C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

g) The responsible party shall:
1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);
2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and
3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.

h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.

i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.

j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.

k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.

l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions (if you need more space for additional conditions, please attach a text document):
See attached "Findings and Special Conditions of the Newton Conservation Commission"

20. For Test Projects subject to 310 CMR 10.05(11), the applicant shall also implement the monitoring plan and the restoration plan submitted with the Notice of Intent. If the conservation commission or Department determines that the Test Project threatens the public health, safety or the environment, the applicant shall implement the removal plan submitted with the Notice of Intent or modify the project as directed by the conservation commission or the Department.

D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? ☐ Yes ☒ No
2. The _____ hereby finds (check one that applies):
   Conservation Commission
   a. ☐ that the proposed work cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw, specifically:

      _____ _____
      1. Municipal Ordinance or Bylaw 2. Citation

      Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order of Conditions is issued.

   b. ☐ that the following additional conditions are necessary to comply with a municipal ordinance or bylaw:

      _____ _____
      1. Municipal Ordinance or Bylaw 2. Citation
3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.
   The special conditions relating to municipal ordinance or bylaw are as follows (if you need more space for additional conditions, attach a text document):

   _____

   _____

   _____

   _____

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
239-738
MassDEP File #

eDEP Transaction #

Newton
City/Town

E. Signatures

This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance.

9/4/15
1. Date of Issuance

Please indicate the number of members who will sign this form.
This Order must be signed by a majority of the Conservation Commission.

6
2. Number of Signers

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate Department of Environmental Protection Regional Office, if not filing electronically, and the property owner, if different from applicant.

Signatures:

☒ by hand delivery on
9/4/15
Date

☐ by certified mail, return receipt requested, on
Date

F. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate MassDEP Regional Office to issue a Superseding Order of Conditions. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order associated with this appeal will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order, or providing written information to the Department prior to issuance of a Superseding Order.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40), and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal ordinance or bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.

G. Recording Information

Prior to commencement of work, this Order of Conditions must be recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land subject to the Order. In the case of registered land, this Order shall also be noted on the Land Court Certificate of Title of the owner of the land subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

_____
Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

_____
Conservation Commission

Please be advised that the Order of Conditions for the Project at:

_____ _____
Project Location MassDEP File Number

Has been recorded at the Registry of Deeds of:

_____ _____ _____
County Book Page

for: _____
Property Owner

and has been noted in the chain of title of the affected property in:

_____ _____
Book Page

In accordance with the Order of Conditions issued on:

_____
Date

If recorded land, the instrument number identifying this transaction is:

_____
Instrument Number

If registered land, the document number identifying this transaction is:

_____
Document Number

_____
Signature of Applicant

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

Request for Departmental Action Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

DEP File Number:

Provided by DEP

A. Request Information

1. Location of Project

a. Street Address | b. City/Town, Zip

c. Check number | d. Fee amount

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

2. Person or party making request (if appropriate, name the citizen group's representative):

Name

Mailing Address

City/Town | State | Zip Code

Phone Number | Fax Number (if applicable)

3. Applicant (as shown on Determination of Applicability (Form 2), Order of Resource Area Delineation (Form 4B), Order of Conditions (Form 5), Restoration Order of Conditions (Form 5A), or Notice of Non-Significance (Form 6)):

Name

Mailing Address

City/Town | State | Zip Code

Phone Number | Fax Number (if applicable)

4. DEP File Number:

B. Instructions

1. When the Departmental action request is for (check one):

- ☐ Superseding Order of Conditions – Fee: $120.00 (single family house projects) or $245 (all other projects)
- ☐ Superseding Determination of Applicability – Fee: $120
- ☐ Superseding Order of Resource Area Delineation – Fee: $120

B. Instructions (cont.)

Send this form and check or money order, payable to the *Commonwealth of Massachusetts,* to:

Department of Environmental Protection
Box 4062
Boston, MA 02211

2. On a separate sheet attached to this form, state clearly and concisely the objections to the Determination or Order which is being appealed. To the extent that the Determination or Order is based on a municipal bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.

3. Send a **copy** of this form and a **copy** of the check or money order with the Request for a Superseding Determination or Order by certified mail or hand delivery to the appropriate DEP Regional Office (see http://www.mass.gov/eea/agencies/massdep/about/contacts/).

4. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Findings and Special Conditions of the Newton Conservation Commission
DEP#239-738, 16 Winchester St (@ Dedham St), Parks & Rec, Redevelop Newton Highlands Playground

Findings (considered as and given equal status ad special conditions)

- Owner: City of Newton, Parks and Rec. Department
- Applicant: Bob DeRubeis
- Representative: Weston and Sampson (Brandon Riley, Gene Bolinger)
- Existing Conditions: Football field, baseball field, open field, basketball courts, tennis courts, play area.
- Jurisdiction: Land Under Water and Waterways – stormwater quality and quantity considerations only. Because the perennial stream is in a box culvert under the playground, there is no Riverfront Area, BVW, or Bank. Because the applicant will only be altering the water entering the stream through existing piped connections, only stormwater standards are being addressed/regulated.
- Approved Project and Activities: The site is in need of rehabilitation and there is an interest in creating official/competition sized fields. Regrade and reconstruct entire grassy portion of the parcel, install handicapped accessible paths throughout the site, install under-drains for all newly constructed fields, install a new parking lot, incorporate new stormwater treatment systems. The applicant will be cutting and filling to level out playing fields, installing new underdrains and stone storage and augmenting soils to improve infiltration.
- NOTE: Because the site is low-lying and on poor soils, opportunities to infiltrate and use low impact development strategies was limited, but DEP stormwater standards have been met and stormwater quality and quantity should be improved on the site as a result of this project. (A detailed stormwater analysis was performed.)
- Final Approved Plans:
  - Plans for Newton Highlands Playground Rehabilitation, 16 Winchester St., by Spurr (Weston and Sampson), August 18, 2015, (revised August 28), 10 sheets and a cover sheet

General

- In case of emergencies, problems, or questions, contact: Jennifer Steel: 617-796-1134.

20. The Newton Conservation Commission shall retain the right to require the submittal of additional information or additional construction measures deemed necessary to ensure the protection of wetland resource areas

21. Violation of any condition stated herein may result in Enforcement Action.

22. In accordance with WPA Form #5, the following must occur in association with this Order:
    a. This Order must be recorded at the Middlesex South Registry of Deeds prior to any work.
    b. No activity shall commence until the Order has been recorded and the 10-day appeal period has passed.
    c. This Order shall not serve to limit the rights of any claimant with legal standing.
    d. This document shall be included in all construction contracts, subcontracts, and specifications dealing with the work proposed and shall supersede any conflicting contract requirements.
    e. Failure to comply with this Condition shall be considered cause for revocation of the Order.
    f. A sign of minimum size 2'x2' shall be displayed clearly visible from the street, showing DEP File Number

Newton's Conditions

Specific to this Project

23. Required activities include:
    a. A pre-construction site visit must be scheduled with the Conservation office
    b. All aspects of the stormwater management system must be installed as per the plans. Any required or desired deviations from this plan shall be requested in writing of the Commission Office, who shall determine if said changes require filing a new Notice of Intent.
    c. The knotweed patch on the northern end of the culverted stream shall be aggressively controlled, and then mowed consistently in an effort to eradicate this population.
    d. To improve water quality in the adjacent wetlands and waterways, the use of herbicides and fertilizers shall be minimized and only slow-release, organic fertilizers shall be used (in conformance with City guidelines).

24. Prohibited activities include: No new connections to the culverted stream are permitted under this Order of Conditions.

Before Work Begins

25. Before **any land disturbing activities** may begin, the applicant must schedule a **pre-construction site visit** with:
    a. Applicant or Applicant's Representative(s)

b. Applicant's Construction Supervisor (person responsible for compliance with this Order and who may be held jointly responsible for any violations and the penalties under the law for said violations)
c. Applicant's Contractor(s)
d. Agent(s) of the Commission

At the pre-construction site visit the following will be checked by an agent of the Conservation Commission:

e. Sedimentation/erosion controls are properly installed in the correct locations
f. DEP File number sign is clearly visible
g. Proof of Recording the Order has been supplied to the Conservation office
h. Contact information for those responsible for construction, sediment controls, and landscaping has been supplied to the Conservation office
i. Anticipated timeline has been supplied to the Conservation office

26. Before any work on-site begins, all other applicable federal, state &/or local permits and/or approvals must be obtained.

27. Notice shall be given to the Newton Conservation Commission no less than two (2) business days prior to the commencement of construction activities.

28. This document shall be included in all construction contracts, subcontracts, and specifications dealing with the work proposed and shall supersede any conflicting contract requirements. The Applicant shall assure that all contractors, subcontractor and other personnel performing the permitted work are fully aware of the permit's terms and conditions. Thereafter, the contractor will be held jointly liable for any violation of this Order resulting from failure to comply with its conditions. Nothing in this paragraph shall limit or restrict the liability of the Applicant for violations of this Order.

During Construction

29. Appropriate erosion control measures must be installed and maintained during the construction period until the site is stable. All soils must be contained on the site. City streets shall be kept clean and catch basins in the immediate area shall be protected from eroding soils. They shall be installed as shown on the approved Plan and shall indicate the limit of work. Hay bales, for any purpose without explicit permission from the Commission, are prohibited by this Order. An adequate supply of extra erosion control materials shall be stored on-site at all times for repair or replacement.

30. A copy of the approved plans and Order of Conditions shall be kept on-site and available for review at all times. All contractors are expected to adhere to the approved plan and these Conditions.

31. Construction materials, vehicles, and earth shall be stored outside of the 100-foot buffer zone of wetland resource areas or 200-foot Riverfront Areas, unless otherwise demarcated and authorized on the approved plans. The storage of dumpsters, construction materials, and stockpiles in the floodplain is prohibited. All stockpiles shall have appropriate erosion controls.

32. Erosion control barriers shall be inspected regularly and maintained at all times. Earth shall not be backfilled against or allowed to overtop erosion control barriers. Silt and sand accumulating behind said barriers shall be removed regularly. If a breach of the erosion control barriers occurs, the Newton Conservation Commission shall be notified, and measures shall be taken to remediate said breach under the guidance of the Commission.

33. Erosion control barriers shall remain in place until a Certificate of Compliance is issued for said work or upon written authorization from the Newton Conservation Commission.

34. "Good housekeeping practices" shall be implemented at all times, including:
    a. appropriate limits to discharges within a Resource Area, Buffer Zone, or an area leading to a stormwater conveyance system
    b. appropriate stockpile area management
    c. appropriate limits to vehicle refueling, washing, etc.
    d. appropriate litter management
    e. appropriate controls for tire tracking

35. During the construction period and prior to issuance of a Certificate of Compliance, members and agents of the Conservation Commission shall have the right to inspect the applicant's project to evaluate compliance with the approved plans and these conditions.

36. Work shall be immediately halted on the site if an Agent of the Commission or DEP determines that any of the work is not in compliance with this Order of Conditions or Special Conditions.

Upon Completion of the Project

37. Upon completion of the project, all exposed soil areas shall be stabilized and re-vegetated. Any excess spoil material which is to remain on Applicant's premises and all areas of disturbed soil shall be left stabilized with mulch, grass or other plantings and protected against erosion and sedimentation. All materials not to remain on Applicant's premises shall be removed from said premises and disposed of in a legal manner.

38. Upon completion of the project, the Conservation Office shall be notified, and permission to remove sediment barriers and the DEP file number sign shall be sought.

39. Upon completion of the project, the applicant must apply for a Certificate of Compliance in accordance with DEP Condition #12, by submitting:
    a. A completed "Request for Certificate of Compliance (WPA Form 8A)."
    b. A written statement from a Professional Engineer registered in Massachusetts certifying that the work has been completed in substantial compliance with this Order of Conditions and the approved plans referenced herein (or approved revisions). If the completed work differs from that in the approved plans and conditions, the report must specify how the project differs.
    c. An as-built plan signed and stamped by a professional land surveyor registered in Massachusetts. This plan will include all structures, grading (topography), drainage, and landscape features and plantings.

On-going Conditions

40. Certain conditions shall remain in effect in perpetuity and shall not expire upon completion of the project or the issuance of a Certificate of Compliance. These conditions are as follows:
    a. To improve water quality in the adjacent wetlands and waterways, the use of herbicides and fertilizers shall be minimized and only slow-release, organic fertilizers shall be used (in conformance with City guidelines).

APPENDIX B

EXISTING BUILDING ENVIROMENTAL HAZARDS ASSESSMENT

Weston & Sampson Engineers, Inc.
Five Centennial Drive
Peabody, Massachusetts 01960-7985
www.westonandsampson.com
Tel: (978)532-1900 Fax: (978)977-0100

Innovative Solutions since 1899

MEMORANDUM

TO: Brandon Riley – Weston & Sampson

FROM: Craig Miner - Weston & Sampson

DATE: July 17, 2015

SUBJECT: **Whitmore Field Facility, Newton, Massachusetts**
Sample result summary

The purpose of this memo is to summarize the results of our sampling/analytical testing of building materials at Whitmore Field located at the intersection of Dedham Street and Upland Avenue in Newton, Massachusetts. The Site consists of a trailer used to house athletic equipment and a concrete building containing bathrooms plus a concession stand. There is also a standalone metal storage unit on the property.

Asbestos Survey

The asbestos sampling was performed by Massachusetts-licensed asbestos inspector Mr. Craig Miner on May 29, 2015. A total of 32 samples of suspect asbestos-containing materials were collected. We performed the bulk sampling in the area according to methods outlined in the U.S. Environmental Protection Agency (EPA) guidance document titled, "Guidance for Controlling Asbestos-Containing Materials in Buildings" (Document No. 560/5-85/024). The results of the sampling are summarized below.

The following ACMs were identified:

Material	Location
Tan window caulk	Trailer exterior
White window caulk	Trailer exterior
Seam caulk	Trailer exterior

No asbestos was detected within samples collected by Weston & Sampson of the following materials:

- White door caulk – trailer
- Textured wall – concrete building
- Window glazing – trailer
- Tar paper under shingle – concrete building
- Black roofing tar/felt – trailer
- Roof shingle – concrete building
- Door caulk – concrete building
- Beige floor tile and associated mastic/backing – trailer

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- Stucco ceiling – trailer
- Sealant on roof – concrete building
- Sealant on roof – trailer

The U.S. Environmental Protection Agency (EPA) defines an Asbestos-Containing Material (ACM) as a material that contains greater than 1 percent (%) asbestos. The Massachusetts Department of Environmental Protection defines an Asbestos-Containing Material (ACM) as a material that contains greater than or equal to 1 percent (%) asbestos. Asbestos was detected in several of the building materials sampled by Weston & Sampson in concentrations greater than or equal to 1%.

The EPA - NESHAP regulations (National Emissions Standard for Hazardous Air Pollutants - 40 CFR Part 61, Subpart M), require that friable ACM, Category I and II non-friable ACM that has become friable, or Category I and II non-friable ACM that will be or has been subject to sanding, grinding, or abrading, be removed from a facility being demolished or renovated prior to any activity that would disturb the material.

The following materials are scheduled to be removed as part of the upcoming renovation project at the facility:

Material	**Location**	**Approximate Quantity**
Tan and white window caulk	Trailer exterior – present on all windows	15 windows ~4x'5'
Seam caulk (vertical seams and perimeter)	Trailer exterior	300 LF

Asbestos Limitations

Our survey did not include an evaluation of underground asbestos cement water/sewer piping, or underground steam lines that may be present at the Site. Limited exploratory demolition was performed to access potentially hidden materials in pipe/other building chases or fire door cores. In addition to the above listed materials, other suspect ACMs may be present at the site that may not have been accessible by Weston & Sampson during our survey. Weston & Sampson investigated for potential asbestos-containing pipe insulation but did not observe any, however the materials may be concealed by existing ceilings and/or walls.

Weston & Sampson recommends that if any suspect materials are uncovered during demolition or renovation activities that were not identified during the survey, that the materials be sampled and analyzed for asbestos content prior to removal.

Polychlorinated Biphenyls (PCB) Survey

Weston & Sampson conducted a limited survey of the Site building for suspect PCB-containing caulking and paint materials. PCB's are regulated under EPA's Toxic Substances Control Act

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(TSCA) regulations (40 CFR Part 761). Caulking and other bulk materials that contain PCBs in concentrations greater than 50 parts per million (ppm) are considered PCB bulk product waste and must be disposed at a facility permitted to accept TSCA waste. Caulking and other bulk materials containing concentrations of PCB's less than 50 ppm are not regulated by TSCA and can be disposed of at a facility permitted to accept the specific concentration of PCBs present in that particular bulk material.

Based on the above referenced limits, none of the materials sampled by Weston & Sampson at the Site will be required to be disposed of at a TSCA permitted facility. Various types and colors of suspect materials were identified within the property and a total of six samples were collected for PCB analysis. These samples were analyzed by Con-Test Analytical Laboratory of East Longmeadow, Massachusetts via EPA Method 8082 with soxhlet extraction. The sample results are summarized below.

PCB Sample Results

Sample Description	Analytical Result (ppm)
P1 –Trailer caulk	Not Detected
P2 –Trailer caulk	Not Detected
P3 –Trailer caulk	Not Detected
P4 –Trailer caulk	Not Detected
P5 – Concrete building caulk	Not Detected
P6 – Concrete building caulk	Not Detected

Lead Paint Screening

On May 29, 2015 Weston & Sampson performed a lead paint screening of the Site buildings. During the screening, we collected paint chip samples from representative painted/coated building components for analysis via Atomic Absorption Spectrometry using method SW846-7420. Samples were analyzed by EMSL Analytical, Inc. of Cinnaminson, New Jersey.

Summary of Findings

The paint screening revealed that none of the paint chip samples collected from the Site building contained levels of lead paint that are greater than the EPA residential standard of 0.50% lead by weight. The results of the samples ranged from <0.010% lead by weight (below the laboratory limit of detection) to 0.017% lead by weight. However, the Occupational Health and Safety Administration (OSHA) Lead in Construction Standard 29 CFR 1926.62 considers any detectable level of lead to be a potential for exposure if dust is generated from disturbances of surfaces coated with paint containing lead.

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Lead Paint Sample Results

Sample ID	Sample Description	Analytical Results (% lead by weight)
L1	Trailer steps	<0.010
L2	Trailer siding	<0.010
L3	Concrete building siding	0.017
L4	Trailer trim	<0.010
L5	Concrete building trim	<0.010
L6	Concrete building interior	<0.010
L7	Concrete building interior	<0.010
L8	Concrete building interior	<0.010

Regulatory Implications and Regulations

Worker Protection

OSHA defines any detectable concentration of lead in paint as a potential lead exposure hazard to workers doing construction/demolition-type work on these surfaces as even small concentrations of lead can result in unacceptable employee exposures depending upon the method of removal and other workplace conditions. Since these conditions can vary greatly, the lead-in-construction standard was written to require exposure monitoring or the use of historical or objective data to ensure that employee exposures do not exceed the Action Level of 30 micrograms per cubic meter of air (µg/m3). Historical data may be applied to some construction tasks involving lead.

OSHA requires that if coated surfaces with paint containing lead are impacted during demolition, then lead exposure monitoring must be performed by the contractor. Contractors and employers of staff who may disturb these materials are obligated to perform a 'negative exposure assessment' in accordance with OSHA regulations in order to document that, although minimal levels of lead are present in these materials, exposure to lead does not exceed the aforementioned OSHA Action Level.

OSHA states that until the employer performs an exposure assessment (or can supply prior data regarding the same type of work which may exempt them from the standard) and documents that employees are not exposed above the permissible exposure limit (PEL) of greater than 50 µg/m3 of air, the employer must treat employees as if they were exposed above the PEL for the following operations:

- manual demolition of structures, manual scraping, manual sanding, and use of heat gun where lead-containing coatings or paints are present;
- abrasive blasting enclosure movement and removal;
- power tool cleaning;
- lead burning;
- using lead-containing mortar or spray painting with lead-containing paint;

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- abrasive blasting, rivet busting, or welding, cutting, or burning on any structure where lead-containing coatings or paint are present;
- cleanup activities where dry expendable abrasive are used; and
- any other task the employer believes may cause exposure in excess of the PEL.

The contractor must provide respiratory protection, protective work clothing and equipment, change areas, hand washing facilities, biological monitoring, and training until an exposure assessment has determined that the work activity will result in an exposure below the PEL. Additional requirements under this standard include a written compliance program as well as record keeping.

Other Hazardous Materials

As part of the survey, Weston & Sampson performed a survey/inventory of potentially hazardous chemicals and mechanical equipment located within the survey area that will require special handling and disposal prior to building renovation / demolition activities. The following hazardous materials were observed within the building:

Material	Quantity	Location
Refrigerator	1	Concrete building
A/C unit	2	Concrete building
Fluorescent light bulbs (4'& 8')	6	Throughout site

OrderID: 201506615

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Lead (Pb) Chain of Custody

EMSL Order ID *(Lab Use Only)*: 201506615

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

Company: Weston + Sampson	EMSL-Bill to: ☒ Same ☐ Different If Bill to is Different note instructions in Comments**
Street:	*Third Party Billing requires written authorization from third party*
City: Peabody State/Province: MA	Zip/Postal Code: Country:
Report To (Name): Craig Miner	Telephone #:
Email Address: minerc@wseinc.com	Fax #: Purchase Order:
Project Name/Number: Newton 2150258	Please Provide Results: ☐ Fax ☐ Email
U.S. State Samples Taken:	CT Samples: ☐ Commercial/Taxable ☐ Residential/Tax Exempt

Turnaround Time (TAT) Options* - Please Check

☐ 3 Hour | ☐ 6 Hour | ☐ 24 Hour | ☐ 48 Hour | ☒ 72 Hour | ☐ 96 Hour | ☐ 1 Week | ☐ 2 Week

Analysis completed in accordance with EMSL's Terms and Conditions located in the Price Guide

Matrix	Method	Instrument	Reporting Limit	Check
Chips ☒ % by wt. ☐ mg/cm² ☐ ppm	SW846-7000B	Flame Atomic Absorption	0.01%	☐
Air	NIOSH 7082	Flame Atomic Absorption	4 µg/filter	☐
	NIOSH 7105	Graphite Furnace AA	0.03 µg/filter	☐
	NIOSH 7300 modified	ICP-AES/ICP-MS	0 5 µg/filter	☐
Wipe* ASTM ☐ non ASTM ☐ *if no box is checked, non-ASTM Wipe is assumed	SW846-7000B	Flame Atomic Absorption	10 µg/wipe	☐
	SW846-6010B or C	ICP-AES	1.0 µg/wipe	☐
	SW846-7000B/7010	Graphite Furnace AA	0.075 µg/wipe	☐
TCLP	SW846-1311/7000B/SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	SW846-1131/SW846-6010B or C	ICP-AES	0.1 mg/L (ppm)	☐
Soil	SW846-7000B	Flame Atomic Absorption	40 mg/kg (ppm)	☐
	SW846-7010	Graphite Furnace AA	0 3 mg/kg (ppm)	☐
	SW846-6010B or C	ICP-AES	2 mg/kg (ppm)	☐
Wastewater Unpreserved ☐ Preserved with HNO_3 pH < 2 ☐	SM3111B/SW846-7000B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	EPA 200 9	Graphite Furnace AA	0.003 mg/L (ppm)	☐
	EPA 200.7	ICP-AES	0.020 mg/L (ppm)	☐
Drinking Water Unpreserved ☐ Preserved with HNO_3 pH < 2 ☐	EPA 200.9	Graphite Furnace AA	0 003 mg/L (ppm)	☐
	EPA 200.8	ICP-MS	0.001 mg/L (ppm)	☐
TSP/SPM Filter	40 CFR Part 50	ICP-AES	12 µg/filter	☐
	40 CFR Part 50	Graphite Furnace AA	3.6 µg/filter	☐
Other:				☐

Name of Sampler: Signature of Sampler:

Sample #	Location	Volume/Area	Date/Time Sampled
L1	Trailer Steps		
L2	Trailer Siding		
L3	Conc. Bldg Siding		
L4	Trailer Trim		
L5	Conc. Trim		

Client Sample #'s: - Total # of Samples:

Relinquished (Client): Date: Time:

Received (Lab): Date: 6/3/15 10:21AM Time:

Comments: W.I. 9.00

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Pls sign

OrderID: 201506615

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

LEAD (Pb) CHAIN OF CUSTODY

EMSL ORDER ID *(Lab Use Only):* 201506615

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Location	Volume/Area	Date/Time Sampled
L6	Conc. Interior		
L7			
L8			

Comments/Special Instructions:

Page 2 of 2 pages

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By AM

OrderID: 201506615

Lead (Pb) Chain of Custody

EMSL Order ID *(Lab Use Only)*: 201506615

EMSL ANALYTICAL, INC
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE (800) 220-3675
FAX (856) 786-5974

Company: Weston + Sampson	EMSL-Bill to: ☒ Same ☐ Different If Bill to is Different note instructions in Comments**
Street:	*Third Party Billing requires written authorization from third party*
City: Peabody State/Province: MA	Zip/Postal Code: Country:
Report To (Name) Craig Miner	Telephone #:
Email Address: minerc@wsp-inc.com	Fax #: Purchase Order
Project Name/Number Newton 2150258	Please Provide Results: ☐ Fax ☐ Email
U.S. State Samples Taken:	CT Samples: ☐ Commercial/Taxable ☐ Residential/Tax Exempt

Turnaround Time (TAT) Options* - Please Check

☐ 3 Hour | ☐ 6 Hour | ☐ 24 Hour | ☐ 48 Hour | ☒ 72 Hour | ☐ 96 Hour | ☐ 1 Week | ☐ 2 Week

*Analysis completed in accordance with EMSL's Terms and Conditions located in the Price Guide

Matrix	Method	Instrument	Reporting Limit	Check
Chips ☒ % by wt. ☐ mg/cm² ☐ ppm	SW846-7000B	Flame Atomic Absorption	0.01%	☐
Air	NIOSH 7082	Flame Atomic Absorption	4 µg/filter	☐
	NIOSH 7105	Graphite Furnace AA	0.03 µg/filter	☐
	NIOSH 7300 modified	ICP-AES/ICP-MS	0.5 µg/filter	☐
Wipe* ASTM ☐ non ASTM ☐ *If no box is checked, non-ASTM Wipe is assumed	SW846-7000B	Flame Atomic Absorption	10 µg/wipe	☐
	SW846-6010B or C	ICP-AES	1.0 µg/wipe	☐
	SW846-7000B/7010	Graphite Furnace AA	0.075 µg/wipe	☐
TCLP	SW846-1311/7000B/SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	SW846-1131/SW846-6010B or C	ICP-AES	0.1 mg/L (ppm)	☐
Soil	SW846-7000B	Flame Atomic Absorption	40 mg/kg (ppm)	☐
	SW846-7010	Graphite Furnace AA	0.3 mg/kg (ppm)	☐
	SW846-6010B or C	ICP-AES	2 mg/kg (ppm)	☐
Wastewater Unpreserved ☐ Preserved with HNO_3 pH < 2 ☐	SM3111B/SW846-7000B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)	☐
	EPA 200.7	ICP-AES	0.020 mg/L (ppm)	☐
Drinking Water Unpreserved ☐ Preserved with HNO_3 pH < 2 ☐	EPA 200.9	Graphite Furnace AA	0.003 mg/L (ppm)	☐
	EPA 200.8	ICP-MS	0.001 mg/L (ppm)	☐
TSP/SPM Filter	40 CFR Part 50	ICP-AES	12 µg/filter	☐
	40 CFR Part 50	Graphite Furnace AA	3.6 µg/filter	☐
Other				☐

Name of Sampler: Signature of Sampler:

Sample #	Location	Volume/Area	Date/Time Sampled
L1	Trailer Steps		
L2	Trailer Siding		
L3	Conc. Bldg Siding		
L4	Trailer Trim		
L5	Conc. Trim		

Client Sample #'s: Total # of Samples:

Relinquished (Client): Craig Miner	Date:	Time:	
Received (Lab):	Date: 6/3/15	Time: 10:21 AM	
Comments: W.I. 9:00			

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Page 1 of ___ pages

OrderID: 201506615

EMSL ANALYTICAL, INC

LEAD (Pb) CHAIN OF CUSTODY

EMSL ORDER ID *(Lab Use Only)*: 201506615

EMSL ANALYTICAL, INC
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE (800) 220-3675
FAX (856) 786-5974

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Location	Volume/Area	Date/Time Sampled
L6	Conc. Interior		
L7			
L8			

Comments/Special Instructions

Page 2 of 2 pages

DEC 1 1 1 1 1
JUN 0 2 2015
By Am

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.EMSL.com cinnaminsonleadlab@emsl.com

EMSL Order:	201506615
CustomerID:	WESA62
CustomerPO:	
ProjectID:	

Attn: **Craig Miner**
Weston & Sampson Engineers, Inc.
5 Centennial Drive
Peabody, MA 01960

Phone:	(978) 532-1900
Fax:	(978) 977-0100
Received:	06/03/15 10:21 AM
Collected:	

Project: **Newton 2150258**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
L1	*201506615-0001*		6/5/2015	<0.010 % wt
	Site: Trailer Steps			
L2	*201506615-0002*		6/5/2015	<0.010 % wt
	Site: Trailer Siding			
L3	*201506615-0003*		6/5/2015	0.017 % wt
	Site: Conc. Bldg Siding			
L4	*201506615-0004*		6/5/2015	<0.010 % wt
	Site: Trailer Trim			
L5	*201506615-0005*		6/5/2015	<0.010 % wt
	Site: Conc. Trim			
L6	*201506615-0006*		6/5/2015	<0.010 % wt
	Site: Conc. Interior			
L7	*201506615-0007*		6/5/2015	<0.010 % wt
	Site: Conc. Interior			
L8	*201506615-0008*		6/5/2015	<0.010 % wt
	Site: Conc. Interior			

Julie Smith - Laboratory Director
NJ-NELAP Accredited:03036
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA-LAP, unless specifically indicated otherwise.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 06/06/2015 11:12:46

EMSL Analytical, Inc.
7 Constitution Way, Suite 107, Woburn, MA 01801
Phone/Fax: (781) 933-8411 / (781) 933-8412
http://www.EMSL.com bostonlab@emsl.com

EMSL Order:	131502950
CustomerID:	WESA62
CustomerPO:	
ProjectID:	

Attn: **Craig Miner**
Weston & Sampson Engineers, Inc.
5 Centennial Drive
Peabody, MA 01960

Phone:	(978) 532-1900
Fax:	(978) 977-0100
Received:	06/02/15 9:00 AM
Analysis Date:	6/4/2015
Collected:	

Project: **Newton Pauk 2150258**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos	
Sample	**Description**	**Appearance**	**%**	**Fibrous**	**%**	**Non-Fibrous**	**%**	**Type**
01A *131502950-0001*	Trailer - White Door Caulk	White Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**
01B *131502950-0002*	Trailer - White Door Caulk	White Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**
02A *131502950-0003*	Trailer - Tan Window Caulk	Gray Non-Fibrous Homogeneous			95%	Non-fibrous (other)	**5%**	**Chrysotile**
02B *131502950-0004*	Trailer - Tan Window Caulk	Gray Non-Fibrous Homogeneous			95%	Non-fibrous (other)	**5%**	**Chrysotile**
03A *131502950-0005*	Trailer - Black Tar on Roofing Metal	Black Non-Fibrous Homogeneous	20%	Cellulose	80%	Non-fibrous (other)		**None Detected**
03B *131502950-0006*	Trailer - Black Tar on Roofing Metal	Black Non-Fibrous Homogeneous	20%	Cellulose	80%	Non-fibrous (other)		**None Detected**
04A *131502950-0007*	Conc. Bldg - Textured Coating	Gray Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**
04B *131502950-0008*	Conc. Bldg - Textured Coating	Gray Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**

Analyst(s)
Kevin Pine (32)

Steve Grise, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Woburn, MA NVLAP Lab Code 101147-0, CT PH-0315, MA AA000188, RI AAL-107T3 and VT AL357102

Initial report from 06/04/2015 14:45:22

EMSL Analytical, Inc.
7 Constitution Way, Suite 107, Woburn, MA 01801
Phone/Fax: (781) 933-8411 / (781) 933-8412
http://www.EMSL.com bostonlab@emsl.com

EMSL Order:	131502950
CustomerID:	WESA62
CustomerPO:	
ProjectID:	

Attn: **Craig Miner**
Weston & Sampson Engineers, Inc.
5 Centennial Drive
Peabody, MA 01960

Phone:	(978) 532-1900
Fax:	(978) 977-0100
Received:	06/02/15 9:00 AM
Analysis Date:	6/4/2015
Collected:	

Project: **Newton Pauk 2150258**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos	
Sample	**Description**	**Appearance**	**%**	**Fibrous**	**%**	**Non-Fibrous**	**%**	**Type**
04C *131502950-0009*	Conc. Bldg - Textured Coating	Gray Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**
05A *131502950-0010*	Conc. Bldg - Roof Shingle	Black Non-Fibrous Homogeneous	10%	Glass	90%	Non-fibrous (other)		**None Detected**
05B *131502950-0011*	Conc. Bldg - Roof Shingle	Black Non-Fibrous Homogeneous	10%	Glass	90%	Non-fibrous (other)		**None Detected**
06A *131502950-0012*	Trailer - Window Glazing	Tan Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**
06B *131502950-0013*	Trailer - Window Glazing	Tan Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**
07A *131502950-0014*	Trailer - White Window Caulk	Gray Non-Fibrous Homogeneous			95%	Non-fibrous (other)	**5%**	**Chrysotile**
07B *131502950-0015*	Trailer - White Window Caulk	Gray Non-Fibrous Homogeneous			95%	Non-fibrous (other)	**5%**	**Chrysotile**
08A *131502950-0016*	Conc. Bldg - Door Caulk	White Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**

Analyst(s)
Kevin Pine (32)

Steve Grise, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Woburn, MA NVLAP Lab Code 101147-0, CT PH-0315, MA AA000188, RI AAL-107T3 and VT AL357102

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EMSL Order:	131502950
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Attn: **Craig Miner**
Weston & Sampson Engineers, Inc.
5 Centennial Drive
Peabody, MA 01960

Phone:	(978) 532-1900
Fax:	(978) 977-0100
Received:	06/02/15 9:00 AM
Analysis Date:	6/4/2015
Collected:	

Project: **Newton Pauk 2150258**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos	
Sample	**Description**	**Appearance**	**%**	**Fibrous**	**%**	**Non-Fibrous**	**%**	**Type**
08B *131502950-0017*	Conc. Bldg - Door Caulk	White Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**
09A *131502950-0018*	Trailer - Seam Caulk	Gray Non-Fibrous Homogeneous			95%	Non-fibrous (other)	**5%**	**Chrysotile**
09B *131502950-0019*	Trailer - Seam Caulk	Gray Non-Fibrous Homogeneous			95%	Non-fibrous (other)	**5%**	**Chrysotile**
10A *131502950-0020*	Conc. Bldg - Tar Paper Under Shingle	Black Non-Fibrous Homogeneous	30%	Cellulose	70%	Non-fibrous (other)		**None Detected**
10B *131502950-0021*	Conc. Bldg - Tar Paper Under Shingle	Black Non-Fibrous Homogeneous	30%	Cellulose	70%	Non-fibrous (other)		**None Detected**
11A *131502950-0022*	Trailer - Beige Floor Tile	Tan Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**
11B *131502950-0023*	Trailer - Beige Floor Tile	Tan Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**
12A *131502950-0024*	Trailer - Beige Floor Tile Mastic/Backing	Black Fibrous Homogeneous	70%	Cellulose	30%	Non-fibrous (other)		**None Detected**

Analyst(s)
Kevin Pine (32)

Steve Grise, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Woburn, MA NVLAP Lab Code 101147-0, CT PH-0315, MA AA000188, RI AAL-107T3 and VT AL357102

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http://www.EMSL.com bostonlab@emsl.com

EMSL Order:	131502950
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Attn: **Craig Miner**
Weston & Sampson Engineers, Inc.
5 Centennial Drive
Peabody, MA 01960

Phone:	(978) 532-1900
Fax:	(978) 977-0100
Received:	06/02/15 9:00 AM
Analysis Date:	6/4/2015
Collected:	

Project: **Newton Pauk 2150258**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
Sample	**Description**	**Appearance**	**%**	**Fibrous**	**%**	**Non-Fibrous**	**% Type**
12B *131502950-0025*	Trailer - Beige Floor Tile Mastic/Backing	Black Fibrous Homogeneous	70%	Cellulose	30%	Non-fibrous (other)	**None Detected**
13A *131502950-0026*	Trailer - Stucco Ceiling	White Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
13B *131502950-0027*	Trailer - Stucco Ceiling	White Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
13C *131502950-0028*	Trailer - Stucco Ceiling	White Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
14A *131502950-0029*	Trailer Roof - Sealant	Black Non-Fibrous Homogeneous	30%	Cellulose	70%	Non-fibrous (other)	**None Detected**
14B *131502950-0030*	Trailer Roof - Sealant	Black Non-Fibrous Homogeneous	30%	Cellulose	70%	Non-fibrous (other)	**None Detected**
15A *131502950-0031*	Trailer Roof - Sealant	Black Non-Fibrous Homogeneous	30%	Cellulose	70%	Non-fibrous (other)	**None Detected**
15B *131502950-0032*	Trailer Roof - Sealant	Black Non-Fibrous Homogeneous	30%	Cellulose	70%	Non-fibrous (other)	**None Detected**

Analyst(s)
Kevin Pine (32)

Steve Grise, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Woburn, MA NVLAP Lab Code 101147-0, CT PH-0315, MA AA000188, RI AAL-107T3 and VT AL357102

Initial report from 06/04/2015 14:45:22

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

June 10, 2015

Craig Miner
Weston & Sampson Engineers MA
5 Centennial Drive
Peabody, MA 01960

Project Location: Newton Park
Client Job Number:
Project Number: 2150258 B.4
Laboratory Work Order Number: 15F0128

Enclosed are results of analyses for samples received by the laboratory on June 2, 2015. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Meghan E. Kelley
Project Manager

Table of Contents

Sample Summary 3

Case Narrative 4

Sample Results 5

15F0128-01 5

15F0128-02 6

15F0128-03 7

15F0128-04 8

15F0128-05 9

15F0128-06 10

Sample Preparation Information 11

QC Data 12

Polychlorinated Biphenyls with 3540 Soxhlet Extraction 12

B123524 12

Dual Column RPD Report 13

Flag/Qualifier Summary 15

Certifications 16

Chain of Custody/Sample Receipt 17

con-test® ANALYTICAL LABORATORY

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Weston & Sampson Engineers MA
5 Centennial Drive
Peabody, MA 01960
ATTN: Craig Miner

REPORT DATE: 6/10/2015

PURCHASE ORDER NUMBER:

PROJECT NUMBER: 2150258 B.4

ANALYTICAL SUMMARY

WORK ORDER NUMBER: 15F0128

The results of analyses performed on the following samples submitted to the CON-TEST Analytical Laboratory are found in this report.

PROJECT LOCATION: Newton Park

FIELD SAMPLE #	LAB ID:	MATRIX	SAMPLE DESCRIPTION	TEST	SUB LAB
P1 Trailer Caulk	15F0128-01	Caulk		SW-846 8082A	
P2 Trailer Caulk	15F0128-02	Caulk		SW-846 8082A	
P3 Trailer Caulk	15F0128-03	Caulk		SW-846 8082A	
P4 Trailer Caulk	15F0128-04	Caulk		SW-846 8082A	
P5 Conc. Bldg Caulk	15F0128-05	Caulk		SW-846 8082A	
P6 Conc. Bldg Caulk	15F0128-06	Caulk		SW-846 8082A	

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

CASE NARRATIVE SUMMARY

All reported results are within defined laboratory quality control objectives unless listed below or otherwise qualified in this report.

SW-846 8082A

Qualifications:

O-32

A dilution was performed as part of the standard analytical procedure.

Analyte & Samples(s) Qualified:

15F0128-01[P1 Trailer Caulk], 15F0128-02[P2 Trailer Caulk], 15F0128-03[P3 Trailer Caulk], 15F0128-04[P4 Trailer Caulk], 15F0128-05[P5 Conc. Bldg Caulk], 15F0128-06[P6 Conc. Bldg Caulk]

The results of analyses reported only relate to samples submitted to the Con-Test Analytical Laboratory for testing.
I certify that the analyses listed above, unless specifically listed as subcontracted, if any, were performed under my direction according to the approved methodologies listed in this document, and that based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Johanna K. Harrington
Manager, Laboratory Reporting

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Newton Park
Sample Description:
Work Order: 15F0128
Date Received: 6/2/2015
Field Sample #: P1 Trailer Caulk
Sampled: 5/29/2015 00:00
Sample ID: 15F0128-01
Sample Matrix: Caulk
Sample Flags: O-32

Polychlorinated Biphenyls with 3540 Soxhlet Extraction

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Aroclor-1016 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:40	JMB
Aroclor-1221 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:40	JMB
Aroclor-1232 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:40	JMB
Aroclor-1242 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:40	JMB
Aroclor-1248 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:40	JMB
Aroclor-1254 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:40	JMB
Aroclor-1260 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:40	JMB
Aroclor-1262 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:40	JMB
Aroclor-1268 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:40	JMB

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
Decachlorobiphenyl [1]	88.2	30-150		6/10/15 4:40
Decachlorobiphenyl [2]	111	30-150		6/10/15 4:40
Tetrachloro-m-xylene [1]	89.8	30-150		6/10/15 4:40
Tetrachloro-m-xylene [2]	107	30-150		6/10/15 4:40

con-test® ANALYTICAL LABORATORY

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Newton Park | Sample Description: | Work Order: 15F0128

Date Received: 6/2/2015

Field Sample #: P2 Trailer Caulk | Sampled: 5/29/2015 00:00

Sample ID: 15F0128-02

Sample Matrix: Caulk

Sample Flags: O-32

Polychlorinated Biphenyls with 3540 Soxhlet Extraction

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Aroclor-1016 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:53	JMB
Aroclor-1221 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:53	JMB
Aroclor-1232 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:53	JMB
Aroclor-1242 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:53	JMB
Aroclor-1248 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:53	JMB
Aroclor-1254 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:53	JMB
Aroclor-1260 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:53	JMB
Aroclor-1262 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:53	JMB
Aroclor-1268 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 4:53	JMB

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
Decachlorobiphenyl [1]	85.8	30-150		6/10/15 4:53
Decachlorobiphenyl [2]	116	30-150		6/10/15 4:53
Tetrachloro-m-xylene [1]	90.8	30-150		6/10/15 4:53
Tetrachloro-m-xylene [2]	110	30-150		6/10/15 4:53

con-test® ANALYTICAL LABORATORY

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Newton Park | Sample Description: | Work Order: 15F0128

Date Received: 6/2/2015

Field Sample #: P3 Trailer Caulk | Sampled: 5/29/2015 00:00

Sample ID: 15F0128-03

Sample Matrix: Caulk

Sample Flags: O-32

Polychlorinated Biphenyls with 3540 Soxhlet Extraction

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Aroclor-1016 [1]	ND	0.78	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:06	JMB
Aroclor-1221 [1]	ND	0.78	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:06	JMB
Aroclor-1232 [1]	ND	0.78	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:06	JMB
Aroclor-1242 [1]	ND	0.78	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:06	JMB
Aroclor-1248 [1]	ND	0.78	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:06	JMB
Aroclor-1254 [1]	ND	0.78	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:06	JMB
Aroclor-1260 [1]	ND	0.78	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:06	JMB
Aroclor-1262 [1]	ND	0.78	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:06	JMB
Aroclor-1268 [1]	ND	0.78	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:06	JMB

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
Decachlorobiphenyl [1]	76.8	30-150		6/10/15 5:06
Decachlorobiphenyl [2]	104	30-150		6/10/15 5:06
Tetrachloro-m-xylene [1]	77.8	30-150		6/10/15 5:06
Tetrachloro-m-xylene [2]	97.7	30-150		6/10/15 5:06

con-test® ANALYTICAL LABORATORY

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Newton Park | Sample Description: | Work Order: 15F0128

Date Received: 6/2/2015

Field Sample #: P4 Trailer Caulk | Sampled: 5/29/2015 00:00

Sample ID: 15F0128-04

Sample Matrix: Caulk

Sample Flags: O-32

Polychlorinated Biphenyls with 3540 Soxhlet Extraction

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Aroclor-1016 [1]	ND	0.74	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:19	JMB
Aroclor-1221 [1]	ND	0.74	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:19	JMB
Aroclor-1232 [1]	ND	0.74	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:19	JMB
Aroclor-1242 [1]	ND	0.74	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:19	JMB
Aroclor-1248 [1]	ND	0.74	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:19	JMB
Aroclor-1254 [1]	ND	0.74	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:19	JMB
Aroclor-1260 [1]	ND	0.74	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:19	JMB
Aroclor-1262 [1]	ND	0.74	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:19	JMB
Aroclor-1268 [1]	ND	0.74	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:19	JMB

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
Decachlorobiphenyl [1]	75.3	30-150		6/10/15 5:19
Decachlorobiphenyl [2]	110	30-150		6/10/15 5:19
Tetrachloro-m-xylene [1]	79.5	30-150		6/10/15 5:19
Tetrachloro-m-xylene [2]	99.0	30-150		6/10/15 5:19

con-test® ANALYTICAL LABORATORY

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Newton Park | Sample Description: | Work Order: 15F0128

Date Received: 6/2/2015

Field Sample #: P5 Conc. Bldg Caulk | Sampled: 5/29/2015 00:00

Sample ID: 15F0128-05

Sample Matrix: Caulk

Sample Flags: O-32

Polychlorinated Biphenyls with 3540 Soxhlet Extraction

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Aroclor-1016 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:32	JMB
Aroclor-1221 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:32	JMB
Aroclor-1232 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:32	JMB
Aroclor-1242 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:32	JMB
Aroclor-1248 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:32	JMB
Aroclor-1254 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:32	JMB
Aroclor-1260 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:32	JMB
Aroclor-1262 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:32	JMB
Aroclor-1268 [1]	ND	0.75	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:32	JMB

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
Decachlorobiphenyl [1]	76.8	30-150		6/10/15 5:32
Decachlorobiphenyl [2]	108	30-150		6/10/15 5:32
Tetrachloro-m-xylene [1]	89.2	30-150		6/10/15 5:32
Tetrachloro-m-xylene [2]	106	30-150		6/10/15 5:32

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39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: Newton Park | Sample Description: | Work Order: 15F0128

Date Received: 6/2/2015

Field Sample #: P6 Conc. Bldg Caulk | Sampled: 5/29/2015 00:00

Sample ID: 15F0128-06

Sample Matrix: Caulk

Sample Flags: O-32

Polychlorinated Biphenyls with 3540 Soxhlet Extraction

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Aroclor-1016 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:45	JMB
Aroclor-1221 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:45	JMB
Aroclor-1232 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:45	JMB
Aroclor-1242 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:45	JMB
Aroclor-1248 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:45	JMB
Aroclor-1254 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:45	JMB
Aroclor-1260 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:45	JMB
Aroclor-1262 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:45	JMB
Aroclor-1268 [1]	ND	0.76	mg/Kg	4		SW-846 8082A	6/6/15	6/10/15 5:45	JMB

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
Decachlorobiphenyl [1]	54.9	30-150		6/10/15 5:45
Decachlorobiphenyl [2]	73.8	30-150		6/10/15 5:45
Tetrachloro-m-xylene [1]	62.3	30-150		6/10/15 5:45
Tetrachloro-m-xylene [2]	73.6	30-150		6/10/15 5:45

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Sample Extraction Data

Prep Method: SW-846 3540C-SW-846 8082A

Lab Number [Field ID]	Batch	Initial [g]	Final [mL]	Date
15F0128-01 [P1 Trailer Caulk]	B123524	0.526	10.0	06/06/15
15F0128-02 [P2 Trailer Caulk]	B123524	0.534	10.0	06/06/15
15F0128-03 [P3 Trailer Caulk]	B123524	0.513	10.0	06/06/15
15F0128-04 [P4 Trailer Caulk]	B123524	0.537	10.0	06/06/15
15F0128-05 [P5 Conc. Bldg Caulk]	B123524	0.534	10.0	06/06/15
15F0128-06 [P6 Conc. Bldg Caulk]	B123524	0.528	10.0	06/06/15

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QUALITY CONTROL

Polychlorinated Biphenyls with 3540 Soxhlet Extraction - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B123524 - SW-846 3540C										
Blank (B123524-BLK1)				Prepared: 06/06/15 Analyzed: 06/09/15						
Aroclor-1016	ND	0.20	mg/Kg							
Aroclor-1016 [2C]	ND	0.20	mg/Kg							
Aroclor-1221	ND	0.20	mg/Kg							
Aroclor-1221 [2C]	ND	0.20	mg/Kg							
Aroclor-1232	ND	0.20	mg/Kg							
Aroclor-1232 [2C]	ND	0.20	mg/Kg							
Aroclor-1242	ND	0.20	mg/Kg							
Aroclor-1242 [2C]	ND	0.20	mg/Kg							
Aroclor-1248	ND	0.20	mg/Kg							
Aroclor-1248 [2C]	ND	0.20	mg/Kg							
Aroclor-1254	ND	0.20	mg/Kg							
Aroclor-1254 [2C]	ND	0.20	mg/Kg							
Aroclor-1260	ND	0.20	mg/Kg							
Aroclor-1260 [2C]	ND	0.20	mg/Kg							
Aroclor-1262	ND	0.20	mg/Kg							
Aroclor-1262 [2C]	ND	0.20	mg/Kg							
Aroclor-1268	ND	0.20	mg/Kg							
Aroclor-1268 [2C]	ND	0.20	mg/Kg							
Surrogate: Decachlorobiphenyl	*3.24*		mg/Kg	4.00		80.9	30-150			
Surrogate: Decachlorobiphenyl [2C]	*4.38*		mg/Kg	4.00		109	30-150			
Surrogate: Tetrachloro-m-xylene	*3.77*		mg/Kg	4.00		94.2	30-150			
Surrogate: Tetrachloro-m-xylene [2C]	*4.41*		mg/Kg	4.00		110	30-150			
LCS (B123524-BS1)				Prepared: 06/06/15 Analyzed: 06/09/15						
Aroclor-1016	1.0	0.20	mg/Kg	1.00		102	40-140			
Aroclor-1016 [2C]	1.2	0.20	mg/Kg	1.00		115	40-140			
Aroclor-1260	1.1	0.20	mg/Kg	1.00		110	40-140			
Aroclor-1260 [2C]	1.2	0.20	mg/Kg	1.00		123	40-140			
Surrogate: Decachlorobiphenyl	*3.48*		mg/Kg	4.00		87.1	30-150			
Surrogate: Decachlorobiphenyl [2C]	*4.65*		mg/Kg	4.00		116	30-150			
Surrogate: Tetrachloro-m-xylene	*3.96*		mg/Kg	4.00		98.9	30-150			
Surrogate: Tetrachloro-m-xylene [2C]	*4.61*		mg/Kg	4.00		115	30-150			
LCS Dup (B123524-BSD1)				Prepared: 06/06/15 Analyzed: 06/09/15						
Aroclor-1016	1.3	0.20	mg/Kg	1.00		126	40-140	21.4	30	
Aroclor-1016 [2C]	1.2	0.20	mg/Kg	1.00		121	40-140	5.08	30	
Aroclor-1260	1.0	0.20	mg/Kg	1.00		104	40-140	5.99	30	
Aroclor-1260 [2C]	1.3	0.20	mg/Kg	1.00		126	40-140	1.95	30	
Surrogate: Decachlorobiphenyl	*3.33*		mg/Kg	4.00		83.3	30-150			
Surrogate: Decachlorobiphenyl [2C]	*4.49*		mg/Kg	4.00		112	30-150			
Surrogate: Tetrachloro-m-xylene	*3.84*		mg/Kg	4.00		96.1	30-150			
Surrogate: Tetrachloro-m-xylene [2C]	*4.47*		mg/Kg	4.00		112	30-150			

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IDENTIFICATION SUMMARY FOR SINGLE COMPONENT ANALYTES

SW-846 8082A

LCS

Lab Sample ID: B123524-BS1

Date(s) Analyzed: 06/09/2015 06/09/2015

Instrument ID (1):

Instrument ID (2):

GC Column (1): ID: (mm)

GC Column (2): ID: (mm)

ANALYTE	COL	RT	RT WINDOW		CONCENTRATION	%D
			FROM	TO		
Aroclor-1016	1	0.00	0.00	0.00	1.0	
	2	0.00	0.00	0.00	1.2	16
Aroclor-1260	1	0.00	0.00	0.00	1.1	
	2	0.00	0.00	0.00	1.2	9

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IDENTIFICATION SUMMARY FOR SINGLE COMPONENT ANALYTES

SW-846 8082A

LCS Dup

Lab Sample ID: B123524-BSD1 Date(s) Analyzed: 06/09/2015 06/09/2015

Instrument ID (1): Instrument ID (2):

GC Column (1): ID: (mm) GC Column (2): ID: (mm)

ANALYTE	COL	RT	RT WINDOW		CONCENTRATION	%D
			FROM	TO		
Aroclor-1016	1	0.00	0.00	0.00	1.3	
	2	0.00	0.00	0.00	1.2	5
Aroclor-1260	1	0.00	0.00	0.00	1.0	
	2	0.00	0.00	0.00	1.3	22

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FLAG/QUALIFIER SUMMARY

*	QC result is outside of established limits.
†	Wide recovery limits established for difficult compound.
‡	Wide RPD limits established for difficult compound.
#	Data exceeded client recommended or regulatory level
	Percent recoveries and relative percent differences (RPDs) are determined by the software using values in the calculation which have not been rounded.
	No results have been blank subtracted unless specified in the case narrative section.
O-32	A dilution was performed as part of the standard analytical procedure.

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

CERTIFICATIONS

Certified Analyses included in this Report

Analyte	Certifications

No certified Analyses included in this Report

The CON-TEST Environmental Laboratory operates under the following certifications and accreditations:

Code	Description	Number	Expires
AIHA	AIHA-LAP, LLC	100033	02/1/2016
MA	Massachusetts DEP	M-MA100	06/30/2015
CT	Connecticut Department of Publilc Health	PH-0567	09/30/2015
NY	New York State Department of Health	10899 NELAP	04/1/2016
NH-S	New Hampshire Environmental Lab	2516 NELAP	02/5/2016
RI	Rhode Island Department of Health	LAO00112	12/30/2015
NC	North Carolina Div. of Water Quality	652	12/31/2015
NJ	New Jersey DEP	MA007 NELAP	06/30/2015
FL	Florida Department of Health	E871027 NELAP	06/30/2015
VT	Vermont Department of Health Lead Laboratory	LL015036	07/30/2015
WA	State of Washington Department of Ecology	C2065	02/23/2016
ME	State of Maine	2011028	06/9/2017
VA	Commonwealth of Virginia	460217	12/14/2015
NH-P	New Hampshire Environmental Lab	2557 NELAP	09/6/2015

con-test® ANALYTICAL LABORATORY
Phone: 413-525-2332
Fax: 413-525-6405
Email: info@contestlabs.com
www.contestlabs.com

CHAIN OF CUSTODY RECORD

15F0128
Rev 04.05.12

39 Spruce Street
East longmeadow, MA 01028

Company Name: Weston & Sampson
Address: 5 Centennial Drive
Peabody, MA 01960
Attention: Craig Miner
Project Location: Newton Park
Sampled By:

Project Proposal Provided? (for billing purposes)
○ yes _____ proposal date

Telephone: 978-532-1900
Project # 2150258 B.4
Client PO#

DATA DELIVERY (check all that apply)
○ FAX ◉ EMAIL ○ WEBSITE
Fax #
Email: minerc@wseinc.com
Format: ○ PDF ○ EXCEL ○ GIS
○ OTHER_____
○ "Enhanced Data Package"

Con-Test Lab ID (laboratory use only)	Client Sample ID / Description	Collection Beginning Date/Time	Collection Ending Date/Time	Composite	Grab	*Matrix Code	Conc Code	PCB 8082 w/ Soxhlet											# of Containers
								6											** Preservation
								I											***Container Code
								A											
01	P1 Trailer Caulk	5-29-15						✓											
02	P2 Trailer Caulk	5-29-15						✓											
03	P3 Trailer Caulk	5-29-15						✓											
04	P4 Trailer Caulk	5-29-15						✓											
05	P5 Conc. Bldg Caulk	5-29-15						✓											
06	P6 Conc. Bldg Caulk	5-29-15						✓											

ANALYSIS REQUESTED

Dissolved Metals
○ Field Filtered
○ Lab to Filter

***Cont. Code:**
A=amber glass
G=glass
P=plastic
ST=sterile
V= vial
S=summa can
T=tedlar bag
O=Other

**Preservation
I = Iced
H = HCL
M = Methanol
N = Nitric Acid
S = Sulfuric Acid
B = Sodium bisulfate
X = Na hydroxide
T = Na thiosulfate
O = Other_____

*Matrix Code:
GW= groundwater
WW= wastewater
DW= drinking water
A = air
S = soil/solid
SL = sludge
O = other_____

Comments:

Please use the following codes to let Con-Test know if a specific sample may be high in concentration in Matrix/Conc. Code Box:

H - High; M - Medium; L - Low; C - Clean; U - Unknown

Relinquished by: (signature)	Date/Time: 6-1-15	
Received by: (signature) 6/2/15	Date/Time: 11 15	
Relinquished by: (signature) 6/2/15	Date/Time: 19:00	
Received by: (signature) 29°C 6/2/15	Date/Time: 19:00	

Turnaround ††
☐ 7-Day
☐ 10-Day
◉ Other 5 day
RUSH †
☐ †24-Hr ☐ †48-Hr
☐ †72-Hr ☐ †4-Day
Require lab approval

Detection Limit Requirements
Massachusetts:
Connecticut:
Other:

Is your project MCP or RCP ?
○ MCP Form Required
○ RCP Form Required
○ MA State DW Form Required PWSID # _____

AIHA LAP, LLC ACCREDITED LABORATORY
ACCREDITED IN ACCORDANCE WITH nelac

NELAC & AIHA-LAP, LLC Accredited
WBE/DBE Certified

†† TURNAROUND TIME STARTS AT 9:00 A.M. THE DAY AFTER SAMPLE RECEIPT UNLESS THERE ARE QUESTIONS ON YOUR CHAIN. IF THIS FORM IS NOT FILLED OUT COMPLETELY OR IS INCORRECT, TURNAROUND TIME WILL NOT START UNTIL ALL QUESTIONS ARE ANSWERED BY OUR CLIENT.

PLEASE BE CAREFUL NOT TO CONTAMINATE THIS DOCUMENT

Table of Contents

39 Spruce St.
East Longmeadow, MA. 01028
P: 413-525-2332
F: 413-525-6405
www.contestlabs.com

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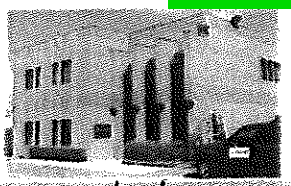

Sample Receipt Checklist

CLIENT NAME: Weston & Sampson **RECEIVED BY:** KKM **DATE:** 6/2/15

1) **Was the chain(s) of custody relinquished and signed?** **Yes** **No** **No CoC Included**
2) **Does the chain agree with the samples?** **Yes** **No**
   If not, explain:
3) **Are all the samples in good condition?** **Yes** **No**
   If not, explain:
4) **How were the samples received:**
   On Ice ☑ Direct from Sampling ☐ Ambient ☐ In Cooler(s) ☑
   Were the samples received in Temperature Compliance of (2-6°C)? **Yes** **No** **N/A**
   Temperature °C by Temp blank _____ Temperature °C by Temp gun 2.9
5) **Are there Dissolved samples for the lab to filter?** **Yes** **No**
   Who was notified _____ Date _____ Time _____
6) **Are there any RUSH or SHORT HOLDING TIME samples?** **Yes** **No**
   Who was notified _____ Date _____ Time _____
7) **Location where samples are stored:**

Permission to subcontract samples? Yes No
(Walk-in clients only) if not already approved
Client Signature: _____

8) **Do all samples have the proper Acid pH:** **Yes** **No** **N/A** _____
9) **Do all samples have the proper Base pH:** **Yes** **No** **N/A** _____
10) **Was the PC notified of any discrepancies with the CoC vs the samples:** **Yes** **No** **N/A**

Containers received at Con-Test

	# of containers		# of containers
1 Liter Amber		8 oz amber/clear jar	
500 mL Amber		4 oz amber/clear jar	6
250 mL Amber (8oz amber)		2 oz amber/clear jar	
1 Liter Plastic		Plastic Bag / Ziploc	
500 mL Plastic		SOC Kit	
250 mL plastic		Non-ConTest Container	
40 mL Vial - type listed below		Perchlorate Kit	
Colisure / bacteria bottle		Flashpoint bottle	
Dissolved Oxygen bottle		Other glass jar	
Encore		Other	

Laboratory Comments:

40 mL vials: # HCl _____ # Methanol _____
Bisulfate _____ # DI Water _____
Thiosulfate _____ Unpreserved _____

Time and Date Frozen:

Doc# 277
Rev. 4 August 2013

Login Sample Receipt Checklist

(Rejection Criteria Listing - Using Sample Acceptance Policy)

Any False statement will be brought to the attention of Client

Question	Answer (True/False) T/F/NA	Comment
1) The cooler's custody seal, if present, is intact.	NA	
2) The cooler or samples do not appear to have been compromised or tampered with.	T	
3) Samples were received on ice.	T	
4) Cooler Temperature is acceptable.	T	
5) Cooler Temperature is recorded.	T	
6) COC is filled out in ink and legible.	T	
7) COC is filled out with all pertinent information.	T	
8) Field Sampler's name present on COC.	F	
9) There are no discrepancies between the sample IDs on the container and the COC.	T	
10) Samples are received within Holding Time.	T	
11) Sample containers have legible labels.	T	
12) Containers are not broken or leaking.	T	
13) Air Cassettes are not broken/open.	NA	
14) Sample collection date/times are provided.	T	no times
15) Appropriate sample containers are used.	T	
16) Proper collection media used.	T	
17) No headspace sample bottles are completely filled.	NA	
18) There is sufficient volume for all requsted analyses, including any requested MS/MSDs.	T	
19) Trip blanks provided if applicable.	NA	
20) VOA sample vials do not have head space or bubble is <6mm (1/4") in diameter.	NA	
21) Samples do not require splitting or compositing.	T	

Who notified of False statements? **Date/Time:**

Doc #277 Rev. 4 August 2013 **Log-In Technician Initials:** KKM **Date/Time:** 6/2/15 19:00

APPENDIX C

BORING LOGS AND TEST PITS

Five Centennial Drive
Peabody, MA 01960-7985
tel: 978-532-1900 fax: 978-977-0100
www.westonandsampson.com

planning, permitting, design, construction, operation, maintenance

Newton Highlands Park – Newton, Massachusetts
Weston & Sampson Project No. 2150258

July 9, 2015

City of Newton, Massachusetts
c/o Brandon Riley
Weston & Sampson
85 Devonshire Street, 3rd Floor
Boston, Massachusetts 02109

RE: Geotechnical Engineering Report
Newton Highlands Park Rehabilitation – Newton, Massachusetts

INTRODUCTION

Weston & Sampson Engineers, Inc. (Weston & Sampson) is pleased to present our geotechnical engineering report for the proposed improvements at Newton Highlands Park in Newton, Massachusetts.

Based on review of concept design drawings prepared by Weston & Sampson (see attached ***Sheets L500 through L503***), we understand that proposed improvements include eight light poles at various locations around new natural turf football and baseball fields, a single story concession/restroom building, a paved parking area, new tennis courts, a new basketball court, a children's play area including small climbing structures, and drainage improvements including catch basins, manholes, pipes, and subsurface drainage at the football and baseball fields. The locations of the proposed site improvements are shown relative to existing site features on the attached concept drawings.

Proposed grades are within approximately 5 ft. of existing grades, with most areas being filled to proposed grades. The south corner of the football field and home plate area of the new baseball field will be raised up to approximately 4 ft. above existing grades. Proposed utility depths were not available at the time of this report but we anticipate that new drainage utilities will be less than 6 feet below existing grades.

Foundations for the new concession/restroom structure are expected to be lightly loaded shallow spread footings bearing approximately 4 ft. below proposed grades. A concrete floor slab on-grade is assumed. Light pole foundations are assumed to consist of cylindrical precast concrete bases installed in drilled (augered) shafts and backfilled with structural concrete.

SITE CONDITIONS

Geologic Conditions

Based on surficial geology information available from the Massachusetts Office of Geographic Information (MassGIS), the site is mapped in an area of sand and gravel deposits overlying till and bedrock at depths up to 50 ft. Bedrock geology is mapped as Roxbury Conglomerate.

Surface Conditions

In general, Newton Highlands Park is bordered by Dedham Street to the south, Upland Avenue to the west, Winchester Street to the northwest, residential properties along Wade Street to the northeast, and an undeveloped forested area to the southeast. The existing ground surface is relatively flat and covered with mowed grass in most areas north of the existing tennis and basketball courts. Based on an existing conditions survey provided by the City of Newton, surface grades at the site are relatively flat with elevations ranging from approximately El. 124 at the northwest end of the site to El. 111 near the center of the site. Elevations reference the North American Vertical Datum of 1988 (NAVD88). The asphalt concrete (AC) pavement at the existing tennis and basketball courts is generally in poor condition with frequent cracks.

Subsurface Explorations

Subsurface conditions were explored by advancing fourteen test borings labeled B1 through B14 to depths up to 24.0 ft. below the existing ground surface at the approximate locations shown on the attached ***Boring Location Plan***. Borings B1 through B8 were advanced to depths between 22.0 to 24.0 ft. BGS in the immediate vicinity of the proposed light poles around the new football and baseball fields. Boring B9 was located at the proposed concession/restroom building and was terminated at a depth of 8.0 ft. due to poor sample recoveries. Boring B9A was advanced to a depth of 24.0 ft. approximately 3 ft. north of B9. Borings B10 through B14 were each advanced to a depth of 6.0 ft. in proposed tennis court, basketball, parking, and playground areas.

The borings were completed on June 15 through 17, 2015 by Crawford Drilling Services, LLC. of Westminster, MA using a track-mounted ATV drill rig and hollow stem auger drilling methods. Standard penetration tests (SPT) were completed in each boring using a standard 24-in. long by 1⅜-in. inside diameter (2-in. outside diameter) split spoon sampler driven 24 in. by blows from a 140-lb. automatic hammer falling 30-in. per blow. Sampling intervals generally ranged from continuous (every 2 ft.) in the topsoil and fill soils to every 5 ft. in the underlying native soils.

A Weston & Sampson representative observed drilling activities in the field. Subsurface conditions encountered in our explorations are described in the following sections and in the attached ***Boring Logs***.

Subsurface Conditions

All borings encountered a surficial topsoil layer ranging in thickness from 1 to 9 inches underlain by SAND FILL to depths of 2 to 4 ft. BGS. Borings B3, B10, B11, and B12 encountered a 6- to 28-inch thick buried layer of TOPSOIL FILL underlying the sand fill. The sand and topsoil fill were underlain by native strata of SILT, SAND, and SILTY SAND to the depths explored. The

subsurface conditions encountered in our explorations are generally consistent with the site history and mapped surficial geology.

The SAND FILL was generally loose to medium dense and contained up to some gravel and up to some silt. The TOPSOIL FILL was generally dark brown, loose to medium dense, silty, and contained little organics. The native SAND (with little silt) and SILTY SAND were generally loose to medium dense. The native SILT was generally medium stiff to stiff and contained up to little fine sand.

Groundwater

Groundwater levels were estimated at approximately 6 ft. in B3, B13, and B14 and at approximately 10 ft. in B1, B2, and B4 through B9(A) based on observation of wet samples. Wet samples were not observed in B10 and B11 to the depth explored (6 ft.). We anticipate that groundwater levels will fluctuate with season, variations in precipitation, construction in the area, and other factors. Perched groundwater conditions could exist close to the ground surface, especially during and after extended periods of wet weather.

RECOMMENDATIONS

General

Based on the subsurface conditions encountered in our explorations and our engineering analyses, the proposed site improvements are feasible following the recommendations contained herein. The primary geotechnical consideration for the proposed light pole foundations is the presence of loose sandy soils beneath the groundwater table. Excavations for foundation construction will require temporary casing and/or use of a drilling fluid to maintain open excavations and support the surrounding ground.

Geotechnical considerations associated with the proposed site grading and shallow foundations include surficial undocumented (non-engineered) fill, a buried layer of topsoil fill encountered in several explorations (B3, B10, B11, and B12), and fine grained silty soils at proposed subgrade elevations. The existing sand fill and topsoil fill are not suitable for support of foundations and other site improvements that would be adversely affected by settlement. The existing fill should be removed from these areas and replaced with structural fill constructed as recommended herein.

It may be possible for the existing fill to remain in place in some areas, such as landscape and field areas and beneath flexible asphalt concrete pavements and walkways, but subgrade conditions in these areas should be evaluated by a Weston & Sampson geotechnical engineer following excavation to subgrade elevations and prior to placement of overlying fill and materials. This will allow us to evaluate the thickness and composition of the existing fill, identify potential risk(s) to the performance of the overlying site improvement(s), and provide recommendations for removal and/or stabilization as necessary. Additional recommendations are provided in the following sections.

Earthwork

Site Preparation - Prior to earthwork construction, the site should be prepared by removing vegetation, topsoil, debris, disturbed soil, and existing site features (to be removed) to expose undisturbed fills and subgrade materials. The borings generally encountered 1 to 9 inches of

topsoil at the ground surface. Deeper stripping depths may be required in areas of loose organic soil typically associated with areas of trees and undergrowth.

Existing fill should be completely removed to expose native undisturbed soils within the zone-of-influence beneath new foundations and other site improvements that could be adversely affected by differential settlement. The zone-of-influence is defined as planes extending horizontally away from the outside edge of foundations (and other features) for 2 ft. horizontally and then down and away at a 1H:1V slope. These areas should be brought back to grade with Structural Fill constructed as recommended below.

Root balls from trees may extend downward several feet and grubbing operations can cause considerable subgrade disturbance. All disturbed material should be removed to undisturbed subgrade and the resulting excavation backfilled with Structural Fill. Common Borrow may be used as backfill in landscape and non-structural areas. In general, the sides of these excavations should be sloped back flatter than 1.5H:1V to ensure that the interface between existing soil and new fill can be thoroughly compacted. Fill should be benched into slopes as described below.

Subgrade Preparation and Protection - Following stripping and site preparation, granular (sandy) subgrades should be recompacted until dense and stable with several passes of a minimum 12-ton smooth drum roller. We recommend that compaction be limited to static methods only; vibratory compaction methods could disturb underlying fine grained materials and should not be used unless recommended by the geotechnical engineer based on observations during construction.

Weston & Sampson should be contacted to evaluate exposed subgrades after recompaction and prior to placement of fill and overlying materials to determine if soft or yielding areas are present and require over-excavation and stabilization. Our evaluation may include visual observations and probing and/or observation of a proof roll using a fully loaded 10-yard dump truck or equipment of similar size and weight.

Soft, loose, or disturbed areas will require additional recompaction or over-excavation, stabilization, and backfill with compacted fill. Crushed stone could be used for stabilization and backfilling provided it is separated from surrounding soils by a non-woven geotextile filter fabric. A woven geosynthetic may also be required depending on the condition of the exposed subgrade and groundwater conditions encountered during the work. The recommended stabilization fabric is a woven geosynthetic with an AOS of #40 to #80 sieve, a minimum puncture resistance of 350 pounds, and a minimum grab tensile strength of 200 pounds (such as Mirafi FW700 or equivalent).

Fill should not be constructed over frozen subgrades. All frozen and frost penetrated materials should be removed prior to placement and compaction of overlying materials. If foundation construction occurs during freezing conditions, insulating blankets, heaters, or other suitable measures should be employed to prevent foundation subgrades from freezing until the foundations are backfilled sufficiently to prevent frost from reaching the footing subgrades.

Soils containing more than trace amounts of silt are highly susceptible to softening and disturbance by construction activity during wet weather. Construction traffic should not operate directly on subgrades if prone to loosening, disturbance, and softening.

Subgrade protection is the responsibility of the contractor and precautions and protective measures appropriate for the weather and traffic conditions during construction should be used during earthwork and foundation construction to preserve the integrity and condition of subgrades. To reduce disturbance due to foot traffic during construction, a few inches of crushed stone can be placed and compacted at the base of foundation excavations.

Fill - Imported well graded sand and gravel fill with less than approximately 10 percent fines (such as MassDOT M1.03.0-type B Gravel Borrow or M2.01.7 Dense-graded Crushed Stone) is recommended for use as Structural Fill beneath proposed structures and as a base course beneath proposed walkways, sidewalks, and slabs. Structural Fill should be placed in maximum 10 inch thick lifts (measured prior to compaction) with each lift compacted to at least 95 percent of its maximum dry density as determined by ASTM D1557 (modified proctor).

Based on the subsurface conditions encountered in our borings, the on-site fill will not be suitable for use as Structural Fill, however, on-site granular soils (sand and sand fill) will likely be suitable for use as Common Borrow in non-structural areas outside proposed structures, pavement, and hardscaped areas. Common Borrow fill material should contain less than approximately 20 percent fines and be free of organics (and organic debris), contamination, and other deleterious materials including cobbles and pieces of debris larger than approximately 6 inches.

Moisture conditioning (i.e. adding or removing moisture) may be required prior to compaction of on-site materials. Once moisture contents are within approximately three percent of optimum, the material should be compacted to at least 92 percent relative to ASTM D1557. Common Borrow fill material should be placed in lifts no greater than 10 inches in loose (uncompacted) thickness.

Fill should be placed in horizontal lifts benched into existing slopes. In confined areas and where only hand-guided compaction equipment can be used, lift thickness should be reduced to not more than six inches. In addition to density testing (and where feasible), we recommend that the fill lifts pass a proof roll using a fully loaded dump 10-wheel truck or equipment of similar size and weight and observed by a geotechnical engineer.

Excavation Considerations - Excavation will be required for site preparation, grading, and foundation construction. Recommendations for light pole foundation construction are provided in a following section. Groundwater and surface water should be controlled during construction and prevented from eroding slopes and disturbing excavation and subgrade materials. Moderate to severe caving of excavation sidewalls should be anticipated. Flowing sand conditions should be expected where seepage is present.

Temporary excavation support will likely be required for excavation depths greater than 4 feet and where groundwater seepage is present. Foundations and utilities should be designed and

constructed so that excavations do not extend into the zone-of-influence beneath existing utilities and other existing site improvements.

We recommend that the type and design of the shoring system be the responsibility of the contractor, who is in the best position to choose a system that fits the overall plan of operation. All excavations should be made in accordance with applicable OSHA and local safety regulations. Dewatering, if required, should also be the responsibility of the contractor.

Trenches - Open utility trench excavations should be completed as recommended above. Pipe bedding should be installed in accordance with the pipe manufacturers' recommendations. If groundwater seepage, standing water, or loose and/or disturbed soils are present at the base of utility trench excavations, we recommend over-excavating the trench by 12 to 18 inches and placing trench stabilization material in the base. Trench stabilization material should consist of well-graded, crushed stone with a maximum particle size of 4 inches and free of deleterious materials. The percent passing the U.S. Standard No. 200 Sieve shall be less than 5 percent by weight when tested in accordance with ASTM C 117.

Trench backfill above the pipe zone in structural areas should consist of well graded, angular crushed stone or sand fill with no more than 8 percent passing a #200 sieve. Common Borrow may be used in non-structural areas. Trench backfill should be compacted to 92 percent relative to ASTM D1557 and to 95 percent relative to ASTM D1557 within 2 feet of finished grades in structural areas. Construction of overlying hard surfaces, such as sidewalks or pavement, should not occur before at least one week after backfilling.

Light Pole Foundations

The light pole foundations should be designed in accordance with the provisions of the current edition of the Massachusetts State Building Code and the Technical Specifications provided by the light pole manufacturer. Based on the subsurface conditions encountered in our explorations, the proposed light poles at boring locations B-1 through B-8 can be supported by precast concrete bases installed in drilled shafts and backfilled with concrete.

Drilled shaft light pole foundation excavations will require use of temporary casing and/or drilling fluid to maintain open excavations and support the surrounding ground. All loose and disturbed materials should be removed from the base of the shaft prior to placement of the precast base. Backfill around the precast base should consist of Portland cement concrete with a minimum (28 day) compressive strength of 3,000 pounds per square inch. The concrete should be placed from the bottom of the shaft using a tremie pipe during extraction of the temporary casing.

An allowable (factored) bearing pressure of 2,000 psf can be used at the base of the pier to resist axial loads provided all loose material and slough is removed as recommended above. An allowable adhesion value of 75 pounds per square foot can be used to calculate resistance to axial loads due to skin friction between the soil and concrete backfill. Skin friction in fill soils should be neglected.

Resistance to lateral loads can be calculated using the soil parameters in the following table. Resistance in the top two feet of foundation embedment should be ignored. Groundwater at the ground surface should be assumed.

	SAND FILL	NATIVE SAND/ SILTY SAND/ SILT
Submerged Unit Weight, lb/ft^3	52.6	52.6
Soil Angle of Internal Friction, ϕ	30	28
Coefficient of Passive Earth Pressure, K_p (Rankine)	3	2.8

Shallow Foundations

General - Based on the subsurface conditions encountered in our explorations, the proposed lightly loaded concession/restroom building and playground structures can be supported by conventional spread footings or piers bearing on proof compacted native sand, undisturbed native medium stiff (or stiffer) silt, or properly constructed structural fill over these materials. A Weston & Sampson geotechnical engineer should observe all foundation subgrades prior to placement of forms and rebar.

Footings bearing on the recommended subgrades should be designed using an allowable bearing pressure of 2,000 psf. The allowable bearing pressure can be increased to 4,000 psf to resist temporary wind and seismic loads provided load eccentricities are within the middle third of the footing. Resistance to lateral loads can be obtained by a passive equivalent fluid pressure of 250 pcf, ignoring the top 12 inches of embedment, and by a footing base friction coefficient of 0.45.

Foundations for proposed structures should be designed in accordance with the provisions of the current edition of the Massachusetts State Building Code (MSBC). Footings should be embedded at least 4 ft. below the nearest proposed adjacent ground surface exposed to freezing.

Shallow foundations constructed as recommended herein are anticipated to undergo total and differential settlements of less than 1-inch and ½-inch, respectively.

Seismic Site Class

In accordance with the International Building Code (IBC) as adapted by the State of Massachusetts State Building Code and based on our explorations and analyses, the subject project should be evaluated using parameters associated with Site Class D.

Slabs

A minimum of 12 inches of clean, angular crushed stone with no more than 6 percent passing a #200 sieve is recommended for underslab stone. We should be contacted to evaluate the subgrade prior to placement of the underslab stone. Underslab stone should be compacted until dense and well-keyed by at least four complete passes of a minimum 10-ton vibratory smooth drum roller. Any areas contaminated with fines or debris should be removed and replaced with

clean stone. If the underslab stone is saturated or trapping water, the water should be removed prior to slab placement.

LIMITATIONS

We have prepared this report for use by the City of Newton and the design and construction teams for this project and this site, only. The information herein could be used for bidding or estimating purposes but should not be construed as a warranty of subsurface conditions. We have made observations only at the aforementioned locations and only to the stated depths. These observations do not reflect soil types, strata thicknesses, water levels or seepage that may exist between observation locations. We should be consulted to observe site and subgrade preparation. We should be consulted to review final design and specifications in order to see that our recommendations are suitably followed. If any changes are made to the proposed improvements, structures, grading, configurations, or construction timing, our recommendations may not be applicable, and we should be consulted.

The preceding recommendations should be considered preliminary, as actual soil conditions may vary. In order for our recommendations to be final, we should be retained to observe actual subsurface conditions encountered. Our observations will allow us to interpret actual conditions and adapt our recommendations if needed.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared. No warranty, expressed or implied, is given.

It has been a pleasure assisting you with this project and we look forward to our continued involvement. Please call if you have any questions.

Very truly yours,

WESTON & SAMPSON, INC.

Christopher J. Palmer, PE
Team Leader

Mark P. Mitsch, PE
Senior Associate

Attachments:

Figure 1 - Boring Location Plan
Boring Logs (14 pages)
Conceptual Design Drawings L500 through L503 (4 pages)

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NOTES:

1. TEST BORINGS DRILLED BY CRAWFORD DRILLING SERVICES, LLC OF GARDNER, MASSACHUSETTS ON JUNE 15 THROUGH 17, 2015.
2. WESTON & SAMPSON ENGINEERS, INC. OBSERVED DRILLING ACTIVITIES IN THE FIELD.
3. EXPLORATION LOCATIONS WERE MEASURED RELATIVE TO EXISTING SITE FEATURES. LOCATIONS SHOWN ARE THEREFORE APPROXIMATE.
4. THE VERTICAL DATUM REFERENCES THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
5. THIS PLAN IS BASED ON AN EXISTING CONDITIONS SURVEY PLAN PROVIDED BY THE CITY OF NEWTON AND COMPLETED BY CHAPPELL ENGINEERING ASSOCIATES, LLC. ON APRIL 6, 2007.

LEGEND

B-1 TEST BORING NUMBER AND APPROXIMATE LOCATION

STATE PLANE GRID

APPROXIMATE SCALE: 1"=80'

0 80 160

FIGURE 1

NEWTON HIGHLANDS PARK
NEWTON, MA

BORING LOCATION PLAN

DESIGNED BY: TJB	CHECKED BY: CJP	DATE: JULY 2015

Weston&Sampson®

O:\Newton MA\Highland Park Geotech\CAD\FIGURE 1 - BORING LOCATION PLAN.dwg

planning, permitting, design, construction, operation, maintenance Weston&Sampson®	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No. B-1 SHEET 1 OF 1 Project No. 2150258 CHKD BY Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	120.5 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/15/15 DATE END 6/15/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

Wet samples observed below 10 ft.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	10/24	0-2	4-8-9-12		2" topsoil over medium dense, fine to medium SAND FILL, some gravel, trace silt; moist.		**2" TOPSOIL**
									SAND FILL
		S2	12/24	2-4	9-7-8-9		Medium dense, brown, fine to medium SAND, little silt; moist.		
		S3	10/24	4-6	3-7-7-6		Medium dense, brown, fine to medium SAND, little silt; moist.		
5									
10		S4	8/24	10-12	3-2-3-4		Loose, brown, fine to medium SAND, little silt; wet.		**SAND**
15		S5	8/24	15-17	2-3-3-4		Loose, brown, fine to medium SAND, little silt; wet.		
20		S6	8/24	20-22	2-4-5-7		Loose, brown, fine to medium SAND, little silt; wet.		
									Terminated at 22 ft.
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-1

planning, permitting, design, construction, operation, maintenance Weston&Sampson®	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No. B-2 SHEET 1 OF 1 Project No. 2150258 CHKD BY Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	117 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/15/15 DATE END 6/15/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

Wet samples observed below 10 ft.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	18/24	0-2	1-3-4-6		9" topsoil over loose, brown, silty fine SAND FILL, little organic silt; trace gravel; moist.		**9" TOPSOIL**
									SAND FILL
		S2	10/24	2-4	8-9-12-11		Medium dense, gray-brown, silty fine SAND; moist.		**SAND/SILTY SAND**
		S3	10/24	4-6	3-5-5-6		Medium dense, brown, silty fine SAND; moist.		
5									
10		S4	8/24	10-12	WOH-2-2-3		Loose, brown, silty fine SAND; wet.		
15		S5	20/24	15-17	3-3-5-4		Loose, organge-brown, fine to medium SAND, some silt; wet.		
20		S6	18/24	20-22	1-2-3-3		Loose, orange-brown, silty fine to medium SAND, wet.		
									Terminated at 22 ft.
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-2

planning, permitting, design, construction, operation, maintenance Weston&Sampson®	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No. B-3 SHEET 1 OF 1 Project No. 2150258 CHKD BY Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	116.5 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/15/15 DATE END 6/15/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

Wet samples observed below 6 ft.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	6/24	0-2	2-2-5-8		6" topsoil; moist. Poor sample recovery.		**6" TOPSOIL**
		S2	18/24	2-4	8-8-9-8		Medium dense, brown, fine to medium SAND FILL, little silt; moist.		**SAND FILL**
		S3	4/24	4-6	4-6-7-8		Medium dense, dark brown, silty SAND FILL, little organics; moist. (TOPSOIL)		**TOPSOIL/FILL**
5		S4	22/24	6-8	6-5-5-5		Top 4": Loose, dark brown, silty SAND FILL, little organics; wet. (TOPSOIL) Bot. 18": Medium dense, brown, fine to medium SAND, little silt; wet.		**SAND**
10		S5	10/24	10-12	2-5-4-3		Loose, brown, fine to medium SAND, little silt; moist.		
		S6	8/24	12-14	2-3-2-3		Loose, brown, fine to medium SAND, little silt; moist.		
15		S7	8/24	15-17	3-5-6-7		Medium dense, brown, fine to medium SAND, little silt; moist.		
20		S8	6/24	20-22	4-3-4-5		Loose, brown, fine to medium SAND, little silt; moist.		**Terminated at 22 ft.**
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-3

planning, permitting, design, construction, operation, maintenance **Weston&Sampson®**	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No. B-4 SHEET 1 OF 1 Project No. 2150258 CHKD BY Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	113 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/15/15 DATE END 6/15/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

Wet samples observed below 10 ft.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	5/24	0-2	3-3-5-8		1" topsoil over loose, brown, fine to medium SAND FILL, some silt, trace gravel; moist.		**1" TOPSOIL**
									SAND FILL
		S2	14/24	2-4	7-7-8-9		Medium dense, gray-brown, silty fine to medium SAND, little gravel; moist.		**SILTY SAND**
		S3	7/24	4-6	2-4-5-4		Stiff, brown, SILT; moist.		
5									
10		S4	10/24	10-12	2-2-3-4		Loose, brown, fine sandy SILT; wet.		**SILT**
15		S5	0/24	15-17	3-4-5-6		No sample recovery.		
		S6	20/24	17-18	3-4-5-4		Medium stiff, brown, SILT; wet.		
20		S7	24/24	20-22	2-3-5-7		Medium stiff, brown, SILT; wet.		
									Terminated at 22 ft.
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-4

planning, permitting, design, construction, operation, maintenance Weston&Sampson®	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No. B-5 SHEET 1 OF 1 Project No. 2150258 CHKD BY Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	114 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/16/15 DATE END 6/16/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

Wet samples observed below 10 ft.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	10/24	0-2	1-1-1-1		4" topsoil over loose, dark brown, silty fine to medium SAND FILL, trace organics; moist.		**4" TOPSOIL**
									SAND FILL
		S2	8/24	2-4	2-4-4-4		Loose, gray, silty fine to medium SAND, little fine gravel; moist.		**SILTY SAND**
		S3	0/24	4-6	7-14-9-9		No sample recovery.		
5		S4	20/24	6-8	5-6-9-13		Stiff, brown, SILT; moist.		**SILT**
10		S5	20/24	10-12	2-6-6-5		Stiff, brown, SILT; wet.		
15		S6	20/24	15-17	3-4-4-6		Loose, brown, silty fine to medium SAND; wet.		**SILTY SAND**
20		S7	15/24	20-22	3-3-4-8		Loose, brown, silty fine to medium SAND; wet.		
									Terminated at 22 ft.
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-5

planning, permitting, design, construction, operation, maintenance Weston&Sampson®	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No. B-6 SHEET 1 OF 1 Project No. 2150258 CHKD BY Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	111.5 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/16/15 DATE END 6/16/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

Wet samples observed below 10 ft.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	12/24	0-2	1-1-4-2		5" topsoil over loose, fine to medium SAND FILL, little fine gravel, little silt; moist.		**5" TOPSOIL**
									SAND FILL
		S2	15/24	2-4	4-9-11-9		Medium dense, gray-brown, silty fine to medium SAND; moist.		**SILTY SAND**
		S3	22/24	4-6	5-6-4-5		Stiff, brown, SILT; moist.		**SILT**
5									
10		S4	15/24	10-12	3-6-7-7		Medium dense, brown, fine SAND, some silt; wet.		
15		S5	22/24	15-17	1-7-7-9		Medium dense, brown, fine to medium SAND, some silt; wet.	1	**SAND**
20		S6	15/24	20-22	WOR/12"-6-7		Loose, brown, fine to medium SAND, some silt; wet.		
		S7	15/24	22-24	2-4-8-7		Medium dense, brown, fine to medium SAND, little silt; wet.		
									Terminated at 24 ft.
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

1. Augers at 15 ft. - observed auger flights settle approximately 3 inches into borehole under self weight.

WOR = weight of rods

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-6

planning, permitting, design, construction, operation, maintenance **Weston&Sampson®**	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No.	B-7
		SHEET	1 OF 1
		Project No.	2150258
		CHKD BY	Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	111 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/16/15 DATE END 6/16/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

Wet samples observed below 10 ft.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	8/24	0-2	1-3-1-1		4" topsoil over loose, brown, fine to medium SAND FILL, trace silt; moist.		**4" TOPSOIL**
									SAND FILL
		S2	20/24	2-4	2-6-9-8		Medium dense, gray-brown, silty fine to medium SAND, trace fine gravel; moist.		**SILTY SAND**
		S3	20/24	4-6	4-4-5-6		Stiff, brown, SILT; moist.		
5									
10		S4	20/24	10-12	3-5-5-10		Stiff, brown, SILT, little fine sand; wet.		**SILT**
15		S5	24/24	15-17	4-5-8-8		Stiff, brown, SILT, little fine sand; wet.		
20		S6	24/24	20-22	1-3-6-7		Stiff, brown, SILT, little fine sand; wet.		
		S7	22/24	22-24	5-5-6-8		Stiff, brown, SILT, little fine sand; wet.		
25									**Terminated at 24 ft.**
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-7

planning, permitting, design, construction, operation, maintenance Weston&Sampson®	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No. B-8 SHEET 1 OF 1 Project No. 2150258 CHKD BY Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	111 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/17/15 DATE END 6/17/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

Wet samples observed below 10 ft.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	10/24	0-2	1-1-2-2		6" topsoil over loose, brown, fine to medium SAND FILL, trace silt; moist.		**6" TOPSOIL**
									SAND FILL
		S2	12/24	2-4	3-8-14-9		Medium dense, gray-brown, silty fine to medium SAND, trace fine gravel; moist.		**SILTY SAND**
		S3	15/24	4-6	3-4-5-7		Stiff, brown, SILT; moist.		
5									**SILT**
10		S4	22/24	10-12	4-6-7-7		Stiff, brown, SILT, little fine sand; wet.		
15		S5	24/24	15-17	3-5-6-6		Medium dense, brown, fine to medium SAND, little silt; wet.		**SAND**
20		S6	24/24	20-22	3-3-8-8		Stiff, brown, SILT, little fine sand; wet.		
		S7	15/24	22-24	10-10-10-8		Stiff, brown, SILT, little fine sand; wet.		**SILT**
									Terminated at 24 ft.
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-8

planning, permitting, design, construction, operation, maintenance **Weston&Sampson®**	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No.	B-9
		SHEET	1 OF 1
		Project No.	2150258
		CHKD BY	Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	114 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/17/15 DATE END 6/17/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

No groundwater observed.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	4/24	0-2	1-1-5-10		2" topsoil over loose, brown, fine to medium SAND FILL, trace silt; moist.		**2" TOPSOIL**
									SAND FILL
		S2	0/24	2-4	10-21-19-11		No sample recovery	1	
		S3	0/24	4-6	15-16-14-16		No sample recovery	1	**(See Boring B-9A)**
5		S4	1/24	6-8	15-16-14-14		Stiff, brown, SILT; moist.	2	
							Relocated boring to B-9A due to low sample recoveries.		**Terminated at 8 ft.**
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:
1 - Sampler likley pushing a gravel or cobble.
2 - Boring B-9 terminated at 8.0 ft. and moved approximatley 3 ft. north to B-9A due to poor sample recovery.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-9

planning, permitting, design, construction, operation, maintenance **Weston&Sampson®**	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No.	B-9A
		SHEET	1 OF 1
		Project No.	2150258
		CHKD BY	Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	114 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/17/15 DATE END 6/17/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

Wet samples observed below 10 ft.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0									**(See Boring B-9)**
		S1	15/24	4-6	2-3-5-7		Stiff, brown, SILT; moist.		**SILT**
5									
10		S2	8/24	10-12	1-1-4-4		Medium dense, brown, fine to medium SAND, little silt; wet.		
15		S3	7/24	15-17	4-4-7-6		Medium dense, brown, fine to medium SAND, little silt; wet.		**SAND**
20		S4	12/24	20-22	4-3-7-7		Medium dense, brown, fine to medium SAND, some silt; wet.		
		S5	15/24	22-24	4-7-7-7		Medium dense, brown, fine to medium SAND, some silt; wet.		
									Terminated at 24 ft.
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-9A

planning, permitting, design, construction, operation, maintenance **Weston&Sampson®**	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No.	B-10
		SHEET	1 OF 1
		Project No.	2150258
		CHKD BY	Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	111 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/16/15 DATE END 6/16/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

No groundwater observed.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	6/24	0-2	1-1-3-4		5 " topsoil over loose, brown, fine to medium SAND FILL, some silt, little fine gravel; moist.		**5" TOPSOIL**
									SAND FILL
		S2	8/24	2-4	1-1-3-3		Loose, dark brown, silty SAND FILL, little organics, trace fine gravel; moist. (TOPSOIL)		**TOPSOIL/FILL**
		S3	12/24	4-6	3-3-5-5		Loose, brown, fine to coarse SAND, little fine gravel, trace to little silt; wet.		**SAND**
5									**Terminated at 6 ft.**
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-10

planning, permitting, design, construction, operation, maintenance **Weston&Sampson®**	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No.	B-11
		SHEET	1 OF 1
		Project No.	2150258
		CHKD BY	Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	112.5 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/17/15 DATE END 6/17/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

No groundwater observed.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	7/24	0-2	1-3-4-3		2" topsoil over loose, brown, fine to medium SAND FILL, little fine gravel, trace silt; moist.		**2" TOPSOIL**
		S2	3/24	2-4	1-2-1-1		Very loose, brown, fine to medium SAND FILL; little gravel, silt, and organics; moist.		**SAND FILL**
		S3	22/24	4-6	4-6-9-11		Top 4": Loose, dark brown, silty SAND FILL; moist. (TOPSOIL)		**TOPSOIL/FILL**
5							Bot. 18": Medium dense, brown, fine to to coarse SAND, little gravel, little silt; wet.		**SAND**
							End of sampling at 6 ft.		**Terminated at 6 ft.**
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-11

planning, permitting, design, construction, operation, maintenance **Weston&Sampson®**	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No.	B-12
		SHEET	1 OF 1
		Project No.	2150258
		CHKD BY	Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	111 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/17/15 DATE END 6/17/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

No groundwater observed.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	6/24	0-2	3-7-6-5		3" topsoil over loose, brown, fine to medium SAND FILL, little fine gravel, trace silt; moist.		**3" TOPSOIL**
									SAND FILL
		S2	5/24	2-4	2-4-1-3		Loose, dark brown, silty SAND, little organics; moist. (TOPSOIL)		**TOPSOIL/FILL**
		S3	8/24	4-6	8-8-15-15		Medium dense, gray-brown, silty fine to medium SAND, little fine gravel; moist.		**SAND**
5									**Terminated at 6 ft.**
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-12

planning, permitting, design, construction, operation, maintenance **Weston&Sampson®**	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No.	B-13
		SHEET	1 OF 1
		Project No.	2150258
		CHKD BY	Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	110.5 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/17/15 DATE END 6/17/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

Wet sample observed at 6 ft.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	15/24	0-2	1-1-3-2		4" topsoil over loose, brown, fine to medium SAND FILL, little silt, trace fine gravel; moist.		**4" TOPSOIL**
									SAND FILL
		S2	5/24	2-4	1-2-2-2		Loose, brown, fine SAND, little silt, trace fine gravel; moist.		**SAND**
		S3	8/24	4-6	3-1-1-1		Very loose, brown, fine to coarse SAND, some gravel, little to some silt; becomes wet at 6 ft.		
5									**Terminated at 6 ft.**
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-13

planning, permitting, design, construction, operation, maintenance **Weston&Sampson®**	PROJECT Newton Highlands Park Newton, MA	REPORT OF BORING No.	B-14
		SHEET	1 OF 1
		Project No.	2150258
		CHKD BY	Christopher J. Palmer, P.E.

BORING Co.	Crawford Drilling Services, LLC	BORING LOCATION	See attached plan.
FOREMAN	Ryan	GROUND SURFACE ELEV.	113 +/- DAT. NAVD88
WSE ENGINEER:	Timothy Blair	DATE START	6/16/15 DATE END 6/16/15

SAMPLER: 2 IN. OD SPLIT SPOON SAMPLER (SPT) DRIVEN 24 INCHES USING A 140 lb. HAMMER.

METHOD: TRACK-MOUNTED ATV RIG WITH 140 lb. AUTO HAMMER USING 4.25 IN. ID HOLLOW-STEM AUGERS

GROUNDWATER READINGS / OBSERVATIONS

Wet sample observed at 6 ft.

DEPTH (ft)	CASING (BLOWS/12")	SAMPLE No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION	NOTES	STRATUM DESCRIPTION
0		S1	7/24	0-2	1-1-3-7		4 " topsoil over loose, gray, silty fine to medium SAND FILL, trace fine gravel; moist.		**4" TOPSOIL**
									SILTY SAND FILL
		S2	14/24	2-4	8-9-10-9		Medium dense, brown, fine to medium SAND FILL, some gravel, little silt; moist.		**SAND**
		S3	12/24	4-6	5-6-9-9		Stiff, brown, SILT; wet.		**SILT**
5							End of sampling at 6 ft.		**Terminated at 6 ft.**
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

NOTES:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. B-14

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MEMORANDUM

TO: Brandon Riley, Roger Alcott

FROM: Alyssa Peck

DATE: May 28, 2015

SUBJECT: Newton Highlands Playground – Test pit results

Test pits were performed at the Newton Highlands Playground on May 7, 2015. They were conducted to better understand the subsurface soil and drainage conditions, so that proper drainage systems can be provided for the renovation and replacement of the existing playing fields, tennis and basketball courts, playground, and parking area. The proposed design also includes a new park support building, new walkways and seating areas, new bleachers and benches, new lighting, and other miscellaneous utilities, sport and site features. The following is a brief summary of the test pit explorations.

The five (5) test pits were performed in various locations throughout the existing playing fields. The test pits were excavation to depths ranging from 4.5 feet to 7 feet below ground surface (b.g.s.). The conditions within test pit 2, test pit 3, and test pit 4 were fairly consistent. Beneath the top soil layer, the material was generally a clay loam or a silty clay loam texture. This soil has poor drainage capabilities. Seasonal high groundwater is estimated to be from 12 inches to 20 inches b.g.s. by visual observation of mottling. Test pit 3 did have weeping groundwater at approximately 3 feet b.g.s.

Test pit 1 was located close to the existing concession building. Below the top soil layer, loamy sand, with varying grain size, was present to the bottom of the 6 foot excavation. Loamy sands can be favorable for drainage. Although groundwater was weeping at the bottom of the excavation, soil mottling could be seen at 2 feet b.g.s.

Adjacent to the existing playground, the top soil of test pit 5 was underlain by a gravelly fill material to a depth of 2 feet b.g.s. Two feet of loam was beneath the gravelly material and underlain by a grey (with mottles) sandy loam soil. Groundwater was weeping out of the test pit wall at about 3.5 feet.

Detailed test pit logs and photos are attached to this memorandum.

TEST PIT LOG

PROJECT NAME/NO.	Newton Highlands Playground / 2150258			**TEST PIT NUMBER**	
LOCATION	Newton, MA			TP - 1	
CLIENT	City of Newton			GROUND SURFACE	
CONTRACTOR	City	FOREMAN:		ELEVATION	118.45 ±
OBSERVED BY	A. Peck	DATE	5/7/15	DEPTH TO GROUNDWATER BELOW	
CHECKED BY		DATE		SURFACE	24" (mottling)

DEPTH BELOW GROUND SURFACE (in.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
10"	Dark brown sandy loam
72"	Very fine loamy sand with pockets of medium loamy sand
	- End of Exploration -

NOTES:

1. Mottling at 24"
2. Weeping at 72"

TEST PIT NUMBER

TP - 1

WESTON & SAMPSON ENGINEERS, INC.

TEST PIT LOG

PROJECT NAME/NO.	Newton Highlands Playground / 2150258			**TEST PIT NUMBER**	
LOCATION	Newton, MA			TP - 1	
CLIENT	City of Newton			GROUND SURFACE	
CONTRACTOR	City	FOREMAN:		ELEVATION	118.45 ±
OBSERVED BY	A. Peck	DATE	5/7/15	DEPTH TO GROUNDWATER BELOW	
CHECKED BY		DATE		SURFACE	24" (mottling)

DEPTH BELOW GROUND SURFACE (in.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION

NOTES:

1. Mottling at 24"
2. Weeping at 72"

TEST PIT NUMBER

TP - 1

WESTON & SAMPSON ENGINEERS, INC.

TEST PIT LOG

PROJECT NAME/NO.	Newton Highlands Playground / 2150258			**TEST PIT NUMBER**	
LOCATION	Newton, MA			TP - 2	
CLIENT	City of Newton			GROUND SURFACE	
CONTRACTOR	City	FOREMAN:		ELEVATION	114.00 ±
OBSERVED BY	A. Peck	DATE	5/7/15	DEPTH TO GROUNDWATER BELOW	
CHECKED BY		DATE		SURFACE	12" (mottling)

DEPTH BELOW GROUND SURFACE (in.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
10"	Dark brown sandy loam
22"	Grey (with mottles) clay loam
30"	Grey silty clay loam
84"	Light brown silty clay loam
	- End of Exploration -

NOTES:

1. Mottles at 12"
2. No weeping or standing groundwater

TEST PIT NUMBER

TP - 2

WESTON & SAMPSON ENGINEERS, INC.

Z:\MA-Boston-Projects\Newton\Newton Highlands 2015\Test Pits\[Test pit logs.xls]TP-3

TEST PIT LOG

PROJECT NAME/NO.	Newton Highlands Playground / 2150258			**TEST PIT NUMBER**	
LOCATION	Newton, MA			TP - 2	
CLIENT	City of Newton			GROUND SURFACE	
CONTRACTOR	City	FOREMAN:		ELEVATION	114.00 ±
OBSERVED BY	A. Peck	DATE	5/7/15	DEPTH TO GROUNDWATER BELOW	
CHECKED BY		DATE		SURFACE	12" (mottling)

DEPTH BELOW GROUND SURFACE (in.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION

NOTES:

TEST PIT NUMBER
TP - 2

WESTON & SAMPSON ENGINEERS, INC.

TEST PIT LOG

PROJECT NAME/NO.	Newton Highlands Playground / 2150258			**TEST PIT NUMBER**	
LOCATION	Newton, MA			TP - 3	
CLIENT	City of Newton			GROUND SURFACE	
CONTRACTOR	City	FOREMAN:		ELEVATION	110.84 ±
OBSERVED BY	A. Peck	DATE	5/7/15	DEPTH TO GROUNDWATER BELOW	
CHECKED BY		DATE		SURFACE	20" (mottling)

DEPTH BELOW GROUND SURFACE (in.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
10"	Dark brown sandy loam
15"	Grey silty clay loam
34"	Clay loam (mottles at 20")
40"	Gravelly coarse sand w/ trace silt
53"	Light brown silty clay loam
	- End of Exploration -

NOTES:

1. Mottles at 20"
2. Weeping at 35"

TEST PIT NUMBER

TP - 3

WESTON & SAMPSON ENGINEERS, INC.

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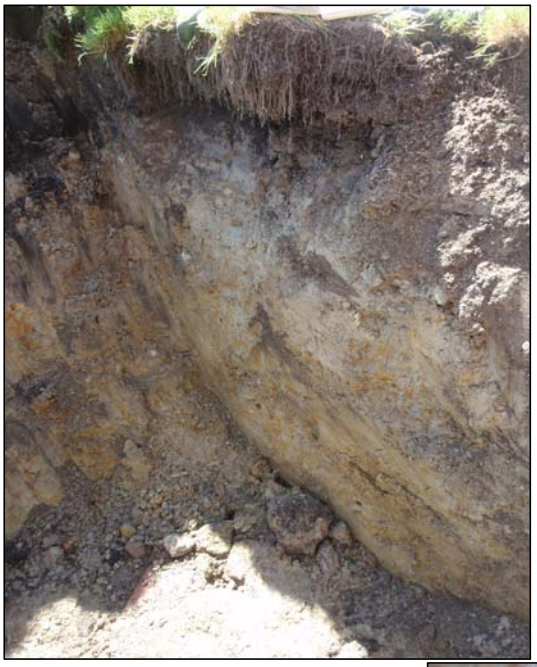
TEST PIT LOG

PROJECT NAME/NO.	Newton Highlands Playground / 2150258			**TEST PIT NUMBER**	
LOCATION	Newton, MA			TP - 3	
CLIENT	City of Newton			GROUND SURFACE	
CONTRACTOR	City	FOREMAN:		ELEVATION	110.84 ±
OBSERVED BY	A. Peck	DATE	5/7/15	DEPTH TO GROUNDWATER BELOW	
CHECKED BY		DATE		SURFACE	20" (mottling)

DEPTH BELOW GROUND SURFACE (in.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION



NOTES:

1. Mottles at 20"
2. Weeping at 35"

TEST PIT NUMBER

TP - 3

WESTON & SAMPSON ENGINEERS, INC.

TEST PIT LOG

PROJECT NAME/NO.	Newton Highlands Playground / 2150258			**TEST PIT NUMBER**	
LOCATION	Newton, MA			TP - 4	
CLIENT	City of Newton			GROUND SURFACE	
CONTRACTOR	City	FOREMAN:		ELEVATION	110.85 ±
OBSERVED BY	A. Peck	DATE	5/7/15	DEPTH TO GROUNDWATER BELOW	
CHECKED BY		DATE		SURFACE	18" (mottling)

DEPTH BELOW GROUND SURFACE (in.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
13"	Dark brown sandy loam
17"	Dark brown loam
24"	Clay loam w/ pockets of fine sand (mottles at 18")
37"	Dark brown sandy loam
46"	Medium brown sandy loam with silty/clayey component
50"	Grey (with mottles) very fine sandy loam
72"	Gravelly coarse sand layer underlain by grey silty clay loam
	- End of Exploration -

NOTES:

1. Mottles at 18"
2. No weeping or standing groundwater

TEST PIT NUMBER

TP - 4

WESTON & SAMPSON ENGINEERS, INC.

TEST PIT LOG

PROJECT NAME/NO.	Newton Highlands Playground / 2150258			**TEST PIT NUMBER**	
LOCATION	Newton, MA			TP - 4	
CLIENT	City of Newton			GROUND SURFACE	
CONTRACTOR	City	FOREMAN:		ELEVATION	110.85 ±
OBSERVED BY	A. Peck	DATE	5/7/15	DEPTH TO GROUNDWATER BELOW	
CHECKED BY		DATE		SURFACE	18" (mottling)

DEPTH BELOW GROUND SURFACE (in.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION

NOTES:

1. Mottles at 18"
2. No weeping or standing groundwater

TEST PIT NUMBER

TP - 4

WESTON & SAMPSON ENGINEERS, INC.

TEST PIT LOG

PROJECT NAME/NO.	Newton Highlands Playground / 2150258			**TEST PIT NUMBER**	
LOCATION	Newton, MA			TP - 5	
CLIENT	City of Newton			GROUND SURFACE	
CONTRACTOR	City	FOREMAN:		ELEVATION	111.20 ±
OBSERVED BY	A. Peck	DATE	5/7/15	DEPTH TO GROUNDWATER BELOW	
CHECKED BY		DATE		SURFACE	40" (weeping)

DEPTH BELOW GROUND SURFACE (in.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION
6"	Dark brown sandy loam
24"	Gravelly medium brown loamy sand fill w/ some cobbles
48"	Very dark brown loam
57"	Grey (with mottles) very fine sandy loam with silty/clayey component
	- End of Exploration -

NOTES:

1. Weeping at 40"
2. Mottles at 48", none above weeping elevation

TEST PIT NUMBER

TP - 5

WESTON & SAMPSON ENGINEERS, INC.

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TEST PIT LOG

PROJECT NAME/NO.	Newton Highlands Playground / 2150258			**TEST PIT NUMBER**	
LOCATION	Newton, MA			TP - 5	
CLIENT	City of Newton			GROUND SURFACE	
CONTRACTOR	City	FOREMAN:		ELEVATION	111.20 ±
OBSERVED BY	A. Peck	DATE	5/7/15	DEPTH TO GROUNDWATER BELOW	
CHECKED BY		DATE		SURFACE	40" (weeping)

DEPTH BELOW GROUND SURFACE (in.)	TEST PIT DIAGRAM AND SOIL DESCRIPTION

NOTES:

1. Weeping at 40"
2. Mottles at 48", none above weeping elevation

TEST PIT NUMBER

TP - 5

WESTON & SAMPSON ENGINEERS, INC.

APPENDIX D

FIELD PREPARATION AND SOIL AMENDMENT GUIDELINES

Sand and Soil Amendments

Seed, Sod and Turf Establishment Specifications

Turf Maintenance for Provisional Acceptance

- The turf maintenance period for establishing a satisfactory stand of turf will begin immediately after any area is seeded and will continue until final acceptance. When entire planted areas are established, the Contractor must request an inspection of the work by the Owner for acceptance. Maintenance will continue in all areas until a uniform turf, both bluegrass and ryegrass has germinated and established a root system over the entire seeded site.
- Maintenance will include re-seeding, weeding, and fertilization if required. This will be determined by the Owner throughout the duration of the turf establishment period.

Satisfactory Stand of Turf and Reseeding

- A satisfactory stand of the turf will be defined as an area that has a minimum of 60 grass plants per square foot with no bare spots larger than 2 square inches. The total bare spot will not exceed 2 percent of the total seeded area to achieve a satisfactory stand of turf, after grass has appeared, re-seeded all areas and parts areas which fail to show a uniform stand of grass. Reseed repeatedly until all areas are satisfactorily established with the specified seed blend and meet the requirement of acceptance as defined above.

Weeding

- Due to the Town of Needham's Zero Pesticide Use Policy, all removal of noxious weeds must be accomplished without the use of herbicides. Protective measures must be taken to limit weed intrusion by adequate seed bed protection, limited time of bare seed bed, soil exposure before seeding and quick establishment of a satisfactory stand of turf. In the event of weed germination and appearance, weeds must be pulled out mechanically by hand or an equivalent method while in the pre-mature seedling stage.

Fertilization

- Additional applications of fertilization shall be applied as required to establish a satisfactory stand of turf within a recommended 4-6 week period or as directed by the Owner. Four weeks after seeding, the Owner will perform a soil test to determine plant available nutrient levels (paste extract) and recommended whether any additional fertilizer applications are necessary prior to acceptance.

Preliminary Inspections

- Prior to the completion of the turf establishment period, preliminary inspection will take place by the Owner to monitor acceptable grow in procedures and the rate of turf establishment. Time of inspection and corresponding field conditions will be established in writing. The

acceptability of the turf in accordance with the turf establishment period will be determined. An unacceptable rate and density of growth during the 2 week period following seeding will be documented by the Owner and forwarded to the Contractor for immediate repair. Preliminary inspections shall continue until final acceptance.

Final Inspection and Acceptance

- A final inspection will be held by the Owner to determine that any deficiencies noted in the preliminary inspections have been corrected. This inspection will determine whether maintenance shall continue in any area or manner. After all necessary corrective work and clean-up has been completed, the Owner will certify in writing the final acceptance of seeded areas.

A&L Eastern Laboratories

7621 Whitepine Road Richmond, Virginia 23237 (804) 743-9401 Fax (804) 271-6446

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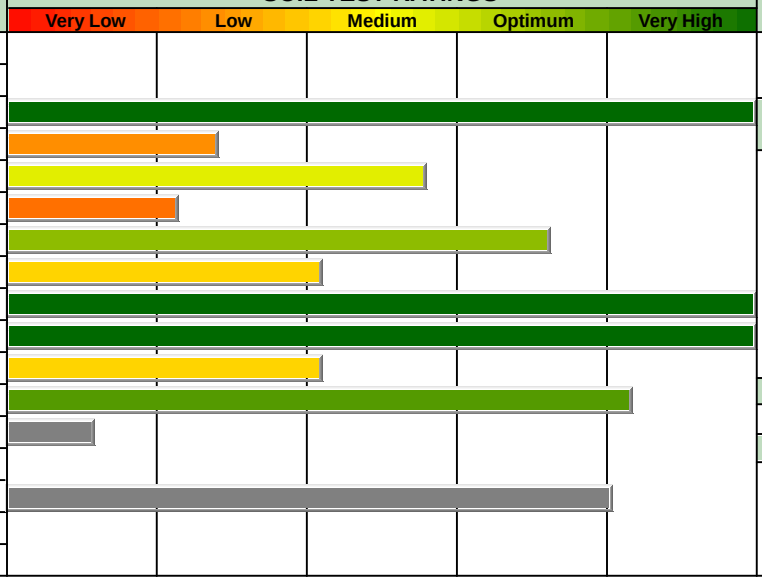
5/26/2015 **SOIL ANALYSIS**

Client :	Grower :	
TURF & SOIL DIAGNOSTICS - NY 35 KING ST TRUMANSBURG NY 14886	WESTON @ SAMPSON LAB#40385 NEWTON HIGHLANDS PLAYGROUND PO:	Report No: 15-142-0521 Cust No: 40751 Date Printed: 05/26/2015 Date Received : 05/22/2015 Date Analysis : 05/25/2015 Page : 1 of 6

Lab Number : 10812 **Field Id :** **Sample Id :** TP-6

Test	Results
Soil pH	5.5
Buffer pH	6.69
Phosphorus (P)	255 ppm
Potassium (K)	68 ppm
Calcium (Ca)	1199 ppm
Magnesium (Mg)	74 ppm
Sulfur (S)	32 ppm
Boron (B)	0.6 ppm
Copper (Cu)	55.1 ppm
Iron (Fe)	300 ppm
Manganese (Mn)	11 ppm
Zinc (Zn)	10.0 ppm
Sodium (Na)	24 ppm
Soluble Salts	
Organic Matter	7.3 % ENR 146
Nitrate Nitrogen	

SOIL TEST RATINGS



Calculated Cation Exchange Capacity

9.3 meq/100g

Calculated Cation Saturation	
%K	1.9
%Ca	64.5
%Mg	6.6
%H	25.7
Hmeq	2.4
%Na	1.1

K : Mg Ratio
0.33

Ca : Mg Ratio
9.77

SOIL FERTILITY GUIDELINES

Crop : Lawn(New) **Rec Units:** LB/1000 SF

(lbs)	LIME	(tons)	N	P_2O_5	K_2O	Mg	S	B	Cu	Mn	Zn	Fe
66			3.5	0	5.5	0.14	0	0	0	0.05	0	0

Crop : Athletic Field **Rec Units:** LB/1000 SF

66			3.5	0	5.5	0.14	0	0	0	0.05	0	0

Comment :

Pauric McGroary

Analysis prepared by: A&L Eastern Laboratories, Inc. Pauric McGroary

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5/26/2015 **SOIL ANALYSIS**

Client :	Grower :	Report No: 15-142-0521
TURF & SOIL DIAGNOSTICS - NY	WESTON @ SAMPSON	Cust No: 40751
35 KING ST	LAB#40385	Date Printed: 05/26/2015
TRUMANSBURG NY 14886	NEWTON HIGHLANDS PLAYGROUND	Date Received : 05/22/2015
		Date Analysis : 05/25/2015
	PO:	Page : 2 of 6

Lab Number : 10812 **Field Id :** **Sample Id :** TP-6

SUGGESTED FERTILIZATION PROGRAM

First Application		Second Application		Third Application		Fourth Application	
#/1000 Sq. Ft.	Fertilizer	#/1000 Sq. Ft.	Fertilizer	#/1000 Sq. Ft.	Fertilizer	#/1000 Sq. Ft.	Fertilizer
10	10-0-20	6	21-0-0	6	21-0-0		
10	10-0-20	6	21-0-0	6	21-0-0		

Comments:

Lawn(New)

Limestone application is targeted to bring soil pH to 6.2.

· Apply dolomitic lime to raise pH and improve the magnesium level.

· If dolomitic lime is not used, apply required magnesium with magnesium oxide. Epsom Salts, K-Mag or Sul-PO-Mag.

· Apply the amount of lime recommended in first page to raise pH

· For existing lawns, lime applications should NOT exceed 50 pounds per 1000 sq. feet per application. Split and apply every 4 to 6 month until the recommended amount is completed.

· Lime is insoluble in water thus move very slowly downward in the soil to raise the pH. For new Lawn, the best result is to broadcast all the recommended lime over the surface, incorporate and mix 6 inches into the soil. If lime is not incorporated and mixed into the soil, lime application should NOT exceed 50 pounds per 1000 sq. feet per application. Split and apply every 4 to 6 month until the recommended amount is completed.

· The amount of fertilizer recommended in the first page is the total amount needed for the entire growing season. Split into 3-4 applications to keep the lawn green and prevent fertilizer loss. Custom blend is best to meet exactly the requirement, if this is impossible, the above specific fertilizer application is a general guideline, if the specified grades can not be found, replace with fertilizer having similar N:P:K ratio. The best time to apply fertilizer for cool season grass (bluegrass, fescue, ryegrass) is in the Fall when grass is growing. For Mid-Atlantic region the time is from late August to November. For Northeast region the time is from mid August to October.Fall application should start as soon as the day time high temperature is below 80-85F, apply with the interval of one month. If you start application late in the Fall and do not finish all three applications, repeat the same applications in the Fall of next year. Spring application is recommended when exceptional fertilizer loss due to heavy Spring rain leaching and the grasses look pale green. Spring application can start as soon as the grass starts to grow in April. In the case of exceptional warm Spring, the application can be made earlier. These grades of fertilizer are the best fit for your requirements for Nitrogen and Phosphorus. It may cause the amount of Potassium being slightly lower than the amount required. This problem should not affect the growth of your lawn and can be easily adjusted from resubmitting soil sample same time next year.

· For a more in depth explanation of the soil test and recommendations, go to our website www.aleastern.com and select the "Lawn and Garden" tab at the top of home page. Under the "How to Understand a Soil Test Report" header you will find the link to the article "Soil Test Report & Fertilizer Recommendation Explained".

Athletic Field

Limestone application is targeted to bring soil pH to 6.2.

· The amount of fertilizer recommended in the first page is the total amount needed for the entire growing season. Split into 3-4 applications to keep the atheletic field green and prevent fertilizer loss. Custom blend is best to meet exactly the requirement, if this is impossible, the above specific fertilizer application is a general guideline, if the specified grades can not be found, replace with fertilizer having similar N:P:K ratio. The best time to apply fertilizer for cool season grass (bluegrass, fescue, ryegrass) is in the Fall when grass is growing. For Mid-Atlantic region the time is from late August to November. For Northeast region the time is from mid August to October. Fall application should start as soon as the day time high temperature is below 80-85F, apply with the interval of one month. If you start late in the Fall, apply the remaining in the Fall of next year. Spring application can start as soon as the grass starts to grow in April. In the case of exceptional warm Spring, or the grass look pale, the application can be made earlier.

Pauric McGroary

Analysis prepared by: A&L Eastern Laboratories, Inc. Pauric McGroary

A&L Eastern Laboratories

7621 Whitepine Road Richmond, Virginia 23237 (804) 743-9401 Fax (804) 271-6446

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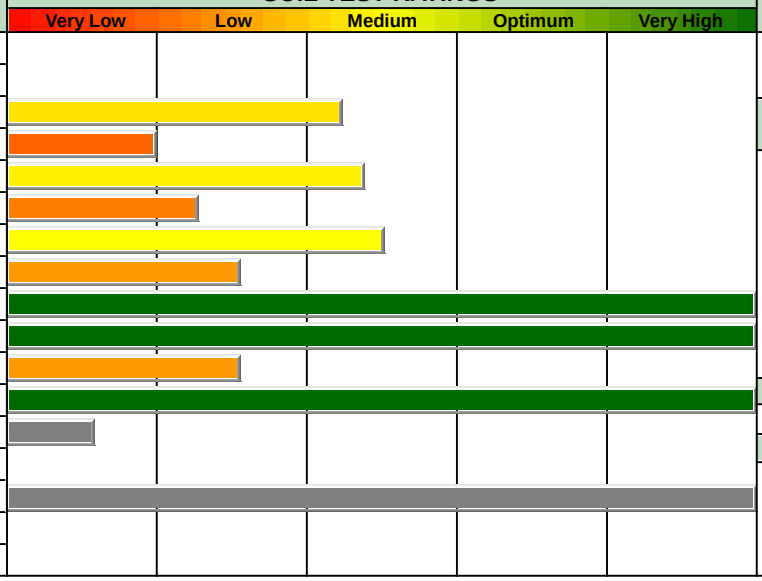
5/26/2015 **SOIL ANALYSIS**

Client :	Grower :	
TURF & SOIL DIAGNOSTICS - NY 35 KING ST TRUMANSBURG NY 14886	WESTON @ SAMPSON LAB#40385 NEWTON HIGHLANDS PLAYGROUND PO:	Report No: 15-142-0521 Cust No: 40751 Date Printed: 05/26/2015 Date Received : 05/22/2015 Date Analysis : 05/25/2015 Page : 3 of 6

Lab Number : 10813 **Field Id :** **Sample Id :** TP-7

Test	Results
Soil pH	5.2
Buffer pH	6.26
Phosphorus (P)	36 ppm
Potassium (K)	75 ppm
Calcium (Ca)	2247 ppm
Magnesium (Mg)	158 ppm
Sulfur (S)	21 ppm
Boron (B)	0.5 ppm
Copper (Cu)	8.0 ppm
Iron (Fe)	342 ppm
Manganese (Mn)	7 ppm
Zinc (Zn)	45.5 ppm
Sodium (Na)	42 ppm
Soluble Salts	
Organic Matter	16.4 % ENR 150
Nitrate Nitrogen	

SOIL TEST RATINGS



Calculated Cation Exchange Capacity

19.6 meq/100g

Calculated Cation Saturation

%K	1.0
%Ca	57.3
%Mg	6.7
%H	34.2
Hmeq	6.7
%Na	0.9

K : Mg Ratio 0.15

Ca : Mg Ratio 8.55

SOIL FERTILITY GUIDELINES

Crop : Lawn(New) **Rec Units:** LB/1000 SF

(lbs)	LIME (tons)	N	P_2O_5	K_2O	Mg	S	B	Cu	Mn	Zn	Fe
183		3.5	1.5	5.5	0	0.30	0	0	0.07	0	0

Crop : Athletic Field **Rec Units:** LB/1000 SF

183		3.5	1.5	5.5	0	0.30	0	0	0.07	0	0

Comment :

Pauric McGroary

Analysis prepared by: A&L Eastern Laboratories, Inc. Pauric McGroary

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7621 Whitepine Road Richmond, Virginia 23237 (804) 743-9401 Fax (804) 271-6446
www.aleastern.com

5/26/2015 **SOIL ANALYSIS**

Client :	Grower :	Report No: 15-142-0521
TURF & SOIL DIAGNOSTICS - NY	WESTON @ SAMPSON	Cust No: 40751
35 KING ST	LAB#40385	Date Printed: 05/26/2015
TRUMANSBURG NY 14886	NEWTON HIGHLANDS PLAYGROUND	Date Received : 05/22/2015
		Date Analysis : 05/25/2015
	PO:	Page : 4 of 6

Lab Number : 10813 **Field Id :** **Sample Id :** TP-7

SUGGESTED FERTILIZATION PROGRAM

First Application		Second Application		Third Application		Fourth Application	
#/1000 Sq. Ft.	Fertilizer	#/1000 Sq. Ft.	Fertilizer	#/1000 Sq. Ft.	Fertilizer	#/1000 Sq. Ft.	Fertilizer
8	16-4-8	8	16-4-8	6	21-3-7		
8	16-4-8	8	16-4-8	6	21-3-7		

Comments:

Lawn(New)

Limestone application is targeted to bring soil pH to 6.2.

· Apply the amount of lime recommended in first page to raise pH

· For existing lawns, lime applications should NOT exceed 50 pounds per 1000 sq. feet per application. Split and apply every 4 to 6 month until the recommended amount is completed.

· Lime is insoluble in water thus move very slowly downward in the soil to raise the pH. For new Lawn, the best result is to broadcast all the recommended lime over the surface, incorporate and mix 6 inches into the soil. If lime is not incorporated and mixed into the soil, lime application should NOT exceed 50 pounds per 1000 sq. feet per application. Split and apply every 4 to 6 month until the recommended amount is completed.

· The amount of fertilizer recommended in the first page is the total amount needed for the entire growing season. Split into 3-4 applications to keep the lawn green and prevent fertilizer loss. Custom blend is best to meet exactly the requirement, if this is impossible, the above specific fertilizer application is a general guideline, if the specified grades can not be found, replace with fertilizer having similar N:P:K ratio. The best time to apply fertilizer for cool season grass (bluegrass, fescue, ryegrass) is in the Fall when grass is growing. For Mid-Atlantic region the time is from late August to November. For Northeast region the time is from mid August to October.Fall application should start as soon as the day time high temperature is below 80-85F, apply with the interval of one month. If you start application late in the Fall and do not finish all three applications, repeat the same applications in the Fall of next year. Spring application is recommended when exceptional fertilizer loss due to heavy Spring rain leaching and the grasses look pale green. Spring application can start as soon as the grass starts to grow in April. In the case of exceptional warm Spring, the application can be made earlier. These grades of fertilizer are the best fit for your requirements for Nitrogen and Phosphorus. It may cause the amount of Potassium being slightly lower than the amount required. This problem should not affect the growth of your lawn and can be easily adjusted from resubmitting soil sample same time next year.

· For a more in depth explanation of the soil test and recommendations, go to our website www.aleastern.com and select the "Lawn and Garden" tab at the top of home page. Under the "How to Understand a Soil Test Report" header you will find the link to the article "Soil Test Report & Fertilizer Recommendation Explained".

Athletic Field

Limestone application is targeted to bring soil pH to 6.2.

· The amount of fertilizer recommended in the first page is the total amount needed for the entire growing season. Split into 3-4 applications to keep the atheletic field green and prevent fertilizer loss. Custom blend is best to meet exactly the requirement, if this is impossible, the above specific fertilizer application is a general guideline, if the specified grades can not be found, replace with fertilizer having similar N:P:K ratio. The best time to apply fertilizer for cool season grass (bluegrass, fescue, ryegrass) is in the Fall when grass is growing. For Mid-Atlantic region the time is from late August to November. For Northeast region the time is from mid August to October. Fall application should start as soon as the day time high temperature is below 80-85F, apply with the interval of one month. If you start late in the Fall, apply the remaining in the Fall of next year. Spring application can start as soon as the grass starts to grow in April. In the case of exceptional warm Spring, or the grass look pale, the application can be made earlier.

Pauric McGroary

Analysis prepared by: A&L Eastern Laboratories, Inc. Pauric McGroary

A&L Eastern Laboratories

7621 Whitepine Road Richmond, Virginia 23237 (804) 743-9401 Fax (804) 271-6446

www.aleastern.com

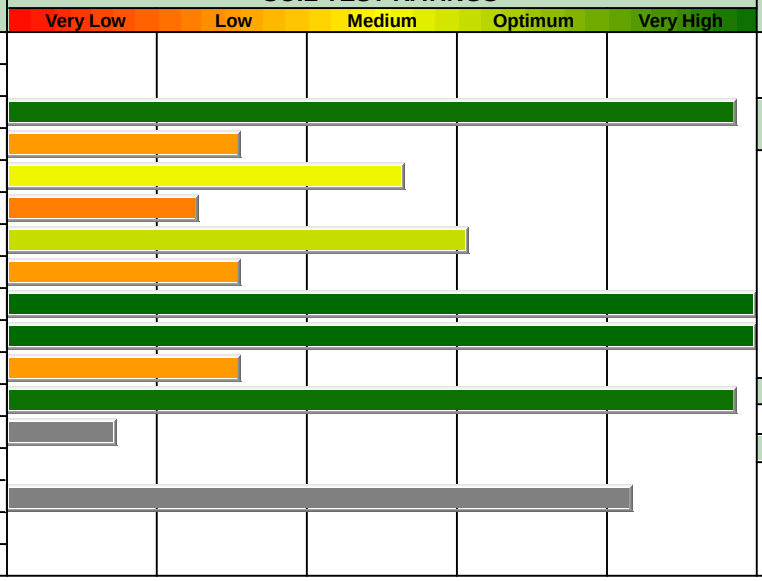
5/26/2015 **SOIL ANALYSIS**

Client :	Grower :	
TURF & SOIL DIAGNOSTICS - NY 35 KING ST TRUMANSBURG NY 14886	WESTON @ SAMPSON LAB#40385 NEWTON HIGHLANDS PLAYGROUND PO:	Report No: 15-142-0521 Cust No: 40751 Date Printed: 05/26/2015 Date Received : 05/22/2015 Date Analysis : 05/25/2015 Page : 5 of 6

Lab Number : 10814 **Field Id :** **Sample Id :** MIX

Test	Results
Soil pH	5.5
Buffer pH	6.63
Phosphorus (P)	199 ppm
Potassium (K)	87 ppm
Calcium (Ca)	1489 ppm
Magnesium (Mg)	101 ppm
Sulfur (S)	27 ppm
Boron (B)	0.5 ppm
Copper (Cu)	41.9 ppm
Iron (Fe)	278 ppm
Manganese (Mn)	7 ppm
Zinc (Zn)	16.1 ppm
Sodium (Na)	34 ppm
Soluble Salts	
Organic Matter	8.3 % ENR 150
Nitrate Nitrogen	

SOIL TEST RATINGS



Calculated Cation Exchange Capacity

11.7 meq/100g

Calculated Cation Saturation

%K	1.9
%Ca	63.6
%Mg	7.2
%H	25.7
Hmeq	3.0
%Na	1.3

K : Mg Ratio 0.25

Ca : Mg Ratio 8.83

SOIL FERTILITY GUIDELINES

Crop : Lawn(New) **Rec Units:** LB/1000 SF

(lbs)	LIME	(tons)	N	P_2O_5	K_2O	Mg	S	B	Cu	Mn	Zn	Fe
82			3.5	0	5.0	0	0.15	0	0	0.07	0	0

Crop : Athletic Field **Rec Units:** LB/1000 SF

82			3.5	0	5.0	0	0.15	0	0	0.07	0	0

Comment :

Pauric McGroary

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Lab Number : 10814 **Field Id :** **Sample Id :** MIX

SUGGESTED FERTILIZATION PROGRAM

First Application		Second Application		Third Application		Fourth Application	
#/1000 Sq. Ft.	Fertilizer	#/1000 Sq. Ft.	Fertilizer	#/1000 Sq. Ft.	Fertilizer	#/1000 Sq. Ft.	Fertilizer
10	10-0-20	6	21-0-0	6	21-0-0		
10	10-0-20	6	21-0-0	6	21-0-0		

Comments:

Lawn(New)

Limestone application is targeted to bring soil pH to 6.2.

· Apply dolomitic lime to raise pH and improve the magnesium level.

· Apply the amount of lime recommended in first page to raise pH

· For existing lawns, lime applications should NOT exceed 50 pounds per 1000 sq. feet per application. Split and apply every 4 to 6 month until the recommended amount is completed.

· Lime is insoluble in water thus move very slowly downward in the soil to raise the pH. For new Lawn, the best result is to broadcast all the recommended lime over the surface, incorporate and mix 6 inches into the soil. If lime is not incorporated and mixed into the soil, lime application should NOT exceed 50 pounds per 1000 sq. feet per application. Split and apply every 4 to 6 month until the recommended amount is completed.

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Athletic Field

Limestone application is targeted to bring soil pH to 6.2.

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Pauric McGroary

Analysis prepared by: A&L Eastern Laboratories, Inc. Pauric McGroary

Turf & Soil Diagnostics

ACCREDITED TESTING Cert #0775.01

MATERIALS TEST REPORT FOR
Newton Highlands Playground

REPORT TO: Weston & Sampson Engineers
Brandon Riley
85 Devonshire St., 3rd Floor
Boston, MA 02109

DATE RECEIVED: May-18-2015
REPORT DATE: May-27-2015
CONDITION OF SAMPLE: Normal

PARTICLE SIZE (ASTM F1632)

		Gravel %		Soil Separate* %			Sieve Size / Sand Fraction Sand Particle Diameter % Retained				
Lab ID#	Sample Name	1/2" 12.5 mm	No. 10 2 mm	Sand	Silt	Clay	No. 18 V. Coarse 1 mm	No. 35 Coarse 0.5 mm	No. 60 Medium 0.25 mm	No. 140 Fine 0.10 mm	No. 270 V. Fine 0.05 mm
40385-1	TP-6	11.9	24.0	53.7	35.4	10.9	11.6	11.4	12.3	11.6	7.0
40385-2	TP-7	0.0	1.4	48.8	39.9	10.9	8.1	12.7	12.3	9.5	6.2
40385-3	Mix	4.1	12.4	47.8	40.5	11.5	7.5	9.6	11.7	11.7	7.3

INFILTRATION RATE (Ksat) / pH / ORGANIC MATTER / TEXTURAL CLASS

Lab ID#	Sample Name		Ksat in/hr	Density lb/cu ft	EC dS/m	pH[1] 1:1	Organic Matter[2] %	Textural Class
40385-1	TP-6					5.1		Gravelly Sandy Loam
40385-2	TP-7					4.8		Loam
40385-3	Mix		0.2	1.14		5.1		Gravelly Loam

*ASTM F1632 Method B ASTM D4972, method A, $CaCl_2$, 25 g sample used [2] ASTM F1647 Method A

Samples were tested as received and comments pertain only to the samples shown.
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Samples were received with a transmittal letter.

Reviewed by _____

35 King Street, Trumansburg NY 14886 ■ Phone: 855-769-4231
E-mail: turfdiag@turfdiag.com ■ Website: http://www.turfdiag.com

Turf & Soil Diagnostics

May 27, 2015

Weston & Sampson Engineers
Newton Highlands Playground

Comments The three soil samples (Lab ID No. 40385-1 to -3) were tested as received. We have no specifications for this project.

The results of the particle size analyses show that the primary difference in the samples is in the amount of gravel present. The TP-6 sample is classified as gravelly sandy loam, per the U.S. Department of Agriculture Soil classification system. This sample has over 35% gravel. The TP-7 sample is classified as loam, and it has only 1.4% gravel. The Mix sample is classified as gravelly loam, as it has approximately 16% gravel.

Loamy soils provide acceptable water and nutrient holding for most turf and landscapes. They provide limited internal drainage and can be prone to excess compaction under heavy use. Fields should be crowned to ensure adequate surface drainage.

Infiltration rate testing was performed on the Mix sample. The infiltration rate is low, indicating that internal drainage can not be expected from this mix.

Sample were sent to A&L Eastern for soil and plant nutrient testing. The test results and fertilizer recommendations are included with this report.

If you have any questions or are in need of further assistance, please contact us. Samples are generally kept on the premises for 45 days after report date. Thank you for using Turf & Soil Diagnostics, Inc.

Sincerely,

Sam Ferro

Sam Ferro
President

Turf & Soil Diagnostics
35 King St. Trumansburg, NY 14886 USA
Phone: 1-855-769-4231 Web: www.turfdiag.com

SILI-CAL SS

SUPER SOLUBLE TECHNOLOGY

SILI-CAL SS is a premier granular fertilizer and soil conditioner that provides outstanding benefits for improving turfgrass strength, resilience, increases greens speed and improves the quality of cut. Silicon is the second most abundant nutrient in the earth's surface; however, weathering and the practice of growing turfgrass on the same soil for many years causes the depletion of important silicon. SILI-CAL SS provides the most soluble form of silicon to help address the plant's silicon requirements.

SILI-CAL SS's silica source is a result of the reduction of phosphate rock with coke in electric arc furnaces to produce elemental Phosphorous. This process involves the intra-reaction of phosphate rock, coke, and silica sand. The reaction requires a temperature of 1300-1500o C. When this heat is achieved, the coke reduces free phosphorus to elemental phosphorus vapor and the silica sand combines with the resulting lime to form calcium silicate in its purest and most soluble form.

Calcium silicate derived from stainless steel processes contains high amounts of iron and aluminum, which bind with the silicon, making those portions insoluble. SILI-CAL SS has the highest percentage of soluble silicon in the industry.

University research has shown turfgrass to be an active accumulator of silicon. When silicon is provided in the soil, it forms mono- and poly- silicic acids. These are taken up by the plant and form what scientists call a "double layer" of protection behind the cuticle. This gives the plant a second layer of protection created by the silicon stored in the cell walls, resulting in the following benefits:

Speeds up recovery of cleat damage
Calcium silicate is stored in root cell walls, increasing mass and density, allowing more efficient uptake of nutrients and water.

Reduces the effects of sodium stress
When silicon is present in leaf tissue the concentration of sodium in the plant is decreased by up to 50%. Calcium silicate buffers sodium in the soil profile as well.

Decreases the effects of drought
Silicon displaces water in plant tissue as desiccation occurs, increasing the plant's strength in drought conditions. Physiologically, increased silicon in plant tissue reduces evapo-transpiration rates and increases the oxygen supply by strengthening air canal walls.

Aids in disease and pest resistance
Deposited silicon in the plant tissue prevents physical penetration by some insects and makes plant cells less susceptible to enzymatic degradation by fungal pathogens.

Significantly increases wear tolerance
Structurally, the presence of silicon creates compression resistance in cell walls which increases traffic resistance.

SILI-CAL SS is formulated in highly dissolvable pellet for ease of application on sports turf (SGN 200). SILI-CAL SS contains 29% soluble silicon, 23% calcium, 3% magnesium and 6% sulfur.

Suggested application rates are 25-50#per 1000 square feet annually. Soil testing is recommended prior to application. To achieve the "silicon effect", ideal tissue levels should reach between 0.8 and 1.2% of silicon.

* Information compiled from the publication "Silicon in Agriculture"

SILI-CAL SS Guaranteed Analysis

Calcium (Ca)	23%
Total Magnesium as (Mg)	3%
2.50% Water Soluble Magnesium (Mg)	
Silicon (SI02)	29%
Derived From: Calcium Silicate and Magnesium Sulfate	
Solubility	22%

SilicoTurf LLC

For a distributor near you, contact Sheree Scarbrough at 614.403.5050, sheree@silicoturf.com

SILI-CAL SS

Granulated Premium Greens Fertilizer
plus Soil Conditioner

GUARANTEED ANALYSIS:

Calcium (Ca)	21.00
Total Magnesium as (Mg)	2.50

2.00 % Water Soluble Magnesium (Mg)
Derived From: Calcium Silicate and Magnesium Sulfate

SOIL CONDITIONER

Guaranteed Analysis Silicone Dioxide (Si02) ...	29.00
Total Other Ingredients:	71.00

Derived From: Calcium Silicate

DIRECTIONS FOR USE

Soil testing prior to application recommended. An initial application rate of 20lbs/1000 sq. ft. is suggested, based on soil analysis. After adequate silicon levels in the soil are achieved, it is suggested that SILI-CAL *SS* be applied once per month at a rate of 10 lbs pounds per 1,000 sq. ft.; not to exceed 50 lbs per 1000 sq. ft. annually.

Calcium Silicate Corporation

Columbia, Tennessee; Lake Harbor, Florida
Mark C. Elizer, President, Ph: (863) 902-0217, Fax: (863) 902-0107

Calcium Silicate Corporation conducts ongoing product testing to assure product safety, however we cannot assume responsibility for misuse of the product, misapplication or any unintended consequences. As such, the end user assumes full responsibility for product use determinations and application.

ON TOP.

Cascade Plus Fertilizer

Synchronized Wetting Agent & Fertilizer Technology

0-0-20

PRECISION LABORATORIES

DESCRIPTION
Cascade Plus Fertilizer combines the proven water infiltration chemistry of Cascade Plus with a unique fertilizer blend. It is designed for golf courses, athletic fields, sports turf, landscapes and park and recreation applications.

BENEFITS
- Delivers long lasting wetting agent and fertilizer in one application.
- Enhances water management, water efficiency and turf quality.
- Prevents localized dry spot.
- Accelerates wilt recovery from drought.
- Reduces the need for repeat spray applications.
- Reduces labor costs and turf maintenance.
- Corrects hydrophobic soil conditions.

GUARANTEED ANALYSIS
Soluble Potash (K_2O) 20.0%
Sulfur (S) 9.0%
Calcium (Ca) 3.0%
Derived from: Potassium sulfate and calcium sulfate.

NONPLANT FOOD INGREDIENTS, ACTIVE INGREDIENTS:
Cascade Plus 10.6%
10% Proprietary Blend of Surfactants,
90% Polyethylene and Propylene Glycols

APPLICATION PRECAUTIONS
- Apply to dry turf or foliage. Irrigation is recommended as soon as possible after application.
- Iron and other plant nutrients can cause staining of sidewalks. Sweep walkways prior to irrigation.
- Keep away from pools, ponds, etc. Do not contaminate potable water.

APPLICATION RATES: TURFGRASS

Lbs of Product per 1,000 Sq. Ft.	Lbs. of Product per Acre	Square Feet per Bag	Oz. Cascade Plus per 1000 Sq. Ft.	Lbs. of Nutrient per 1000 Sq. Ft.		
				N	P	K
5	217.8	10000	8	0	0	1.0
6	261.4	8333	9.6	0	0	1.2
7	304.9	7143	11.2	0	0	1.4
8	348.5	6250	12.8	0	0	1.6
9	392.0	5556	14.4	0	0	1.8
10	435.6	5000	16	0	0	2.0

APPLICATION RECOMMENDATION
Use at 5 lbs. per 1000 ft² to obtain 8 ounces of Cascade Plus per 1000 ft².

SPREADER SETTINGS
Big Foot..... G–H
Spyker..... 4½
Lesco (029600)..... E–E½
Scotts (R8A)..... 1½–J
Earthway..... 11–12
Note: Spreader settings are guidelines only. Spreaders should be checked for accuracy and calibrated by the user. For the most current settings check www.precisionlab.com.

SGN: 120
Bulk Density: 63 lbs./ft3
Note: SGN & Bulk Density are lot specific. Actual numbers may vary slightly.

KEEP OUT OF REACH OF CHILDREN
CAUTION

PRECAUTIONARY STATEMENTS
For outdoor use only.

PERSONAL PROTECTIVE EQUIPMENT (PPE)
If possibility for eye contact exists, wear protective eyewear. Cover open sores.

STATEMENT OF PRACTICAL TREATMENT
If In Eyes: Flush eyes with plenty of water for 15 minutes. Seek medical attention if irritation persists.
If On Skin: Wash with soap and water. Seek medical attention if irritation persists.
If Inhaled: Move individual to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Seek immediate medical attention.
If Swallowed: Drink plenty of water.

STORAGE AND DISPOSAL
Store in a dry location in temperatures above 30°F. Dispose of in accordance with federal, state and local requirements. May be placed in household waste. Do not reuse packaging. Dispose of packaging when empty.

CONDITIONS OF SALE
Note: Read the information contained herein before buying or using this product. If the stated terms are not acceptable, return the product at once, unopened. It is critical that this product be used and mixed only as specified on this label. Neither the manufacturer nor the seller makes any representation or warranty, expressed or implied, with respect to the results from the use of this material. Buyer and user assume all risks of use and/or handling. Precision Laboratories, LLC warrants that this material is reasonably fit for use as specified on this label. No agent or representative is authorized to make any other representations concerning this material. Unforeseen factors beyond Precision's control prevent elimination of risks in connection with the use of its chemicals. Such risks include, but are not limited to, damage to plants and/or crops to which the material is applied, or lack of complete control and damage caused by drift to other plants or crops. Such risks may occur even though the product is reasonably fit for use as stated herein and even though label directions are followed. Follow directions carefully. Timing, mixture, method of application, weather and other conditions are influencing factors in the use of this product and are beyond the control of the seller. Except to the extent prohibited by applicable law, the exclusive remedy of the user or buyer and the limit of liability of the company or any other seller for any and all losses, personal injuries or damages resulting from the use of this product, shall be the purchase price paid by the user or buyer for the quantity of product involved.

SPECIMEN LABEL

Cascade is a trademark of Precision Laboratories, LLC
© PRECISION LABORATORIES, LLC, Waukegan, IL 60085 USA
For 24-hour technical assistance when using this product in the USA and Canada, call: 1-800-323-8351
For 24-hour emergency service when using this product in the USA and Canada, call CHEMTREC: 1-800-424-9300
7/2012 F1467

Precision Laboratories, LLC
1429 S. Shields Dr., Waukegan, IL 60085
Phone: (847) 596-3001 Fax: (847) 596-3017
Customer Service: (800) 323-6280
E-Mail: info@precisionlab.com
Web Site: www.precisionlab.com

STARTER TOP.

LEBANON®

Country Club.

FERTILIZER

FAIRWAY GRADE FORMULA

HOMOGENEOUS GRANULES FOR PROFESSIONAL TURF

COVERS 12,500 SQ. FT.

13-25-12

SIZE GUIDE NUMBER SGN 195

GUARANTEED ANALYSIS

0 88685 35573 8

F099 21-35573

SUGGESTED SPREADER SETTINGS

Fertilizer may cause irritation of eyes, nose, throat and skin. In case of contact with skin or eyes, flush with plenty of water; for eyes, get medical attention.

KEEP OUT OF REACH OF CHILDREN.
CAUTION

LebanonTurf

50 Lbs. (22.7 kg) Net Weight

FAIRWAY GRADE FORMULA

HOMOGENEOUS GRANULES FOR PROFESSIONAL TURF

COVERS 12,500 SQ. FT.

13-25-12

SIZE GUIDE NUMBER SGN 195

GUARANTEED ANALYSIS

Total Nitrogen (N) **13%**
13.0% Ammoniacal Nitrogen
Available Phosphate (P_2O_5) **25%**
Soluble Potash (K_2O) **12%**
Sulfur (S) 5.7%
5.7% Combined Sulfur (S)
Iron (Fe) 0.5%
0.05% Water Soluble Iron (Fe)

Derived From: Ammonium Phosphate, Ammonium Sulfate, Muriate of Potash.
Chlorine (Cl) not more than 8.0%

0 88685 35573 8

F699 **21-35573**

NOTICE: This product contains the secondary nutrient iron. Iron may stain concrete surfaces and should not be applied on dry or water dampened concrete and should be removed from these areas promptly by sweeping or blowing. Do not wash off with water.

Information regarding the contents and levels of metals in this product is available on the Internet at: http://www.regulatory-info-lebsea.com

FOR FLORIDA: We recommend that you follow the Golf Course BMP's at:
http://www.dep.state.fl.us/water/nonpoint/docs/nonpoint/gifbmp07.pdf

DIRECTIONS FOR USE
Apply during the turf growing season or work into the soil prior to seeding.

To feed at the rate of 11/2 lb. Available Phosphate per 1,000 sq. ft., apply this product at 6 lbs. per 1,000 sq. ft. or 261 lbs. per acre. Supplemental applications of lawn fertilizer are needed to achieve a minimum 1 pound nitrogen per 1,000 sq. ft.

SUGGESTED SPREADER SETTINGS

Spreader	Speed		Width of Coverage	Settings		Spreader	Speed		Width of Coverage	Settings	
	Ground MPH	PTO RPM		1# P_2O_5	½# P_2O_5		Ground MPH	PTO RPM		1# P_2O_5	½# P_2O_5
LebanonTurf	3		8 ft.	5	4	Lesco® (Letter Dial)	3		8 ft.	K	H
Andersens AccuPro®	3		8 ft.	O	H	PennMulch® HVO	3		8 ft.	O	J
Earthway® Rotary	3		8 ft.	18	15	ProScape® SS	3		8 ft.	O	J
Gandy®	3			35	30	Spyker	3		8 ft.	5	4
Lely (HR, W 1250, 1500, 2010)	5		39 ft.	7II	5II	Vicon (all models)	5	540	35 ft.	30	25

These settings were calibrated and field tested. However, age and condition of spreader, speed of operation, and evenness of terrain may require slightly different settings for desired coverage.

Country Club and the Lebanon Diamond are registered trademarks of Lebanon Seaboard Corporation.

Fertilizer may cause irritation of eyes, nose, throat and skin.
In case of contact with skin or eyes, flush with plenty of water;
for eyes, get medical attention.

KEEP OUT OF REACH OF CHILDREN.
CAUTION

LebanonTurf

For technical assistance or more information about our products visit www.LebanonTurf.com

Manufactured by:
Lebanon Seaboard Corporation
1600 E. Cumberland St. • Lebanon, PA 17042
Made in the U.S.A.
www.LebanonTurf.com

50 Lbs. (22.7 kg) Net Weight

Directions for use

Turf (all grasses)

Apply 10 pounds of 5-4-5 per 1000 square feet of turf area (½ lb of nitrogen per 1000 sq ft), 4 to 6 times a year as needed. For best results, adequate irrigation should be practiced after application and throughout the growing season.

Shrubs

Apply 1 pound of 5-4-5 around the base of the plant and lightly work into the soil, being careful not to disturb surface roots. Larger shrubs or stressed plants will benefit from larger feedings.

Trees

For young or small trees (1 to 3 inch diameter) apply 2 to 3 pounds of 5-4-5 per inch of trunk diameter evenly under the canopy drip line. Increase the application rate to 3 to 4 pounds for larger trees. Apply in Spring and Fall, thoroughly watering after each application.

Manufactured for:

EarthWorks
1500 Uhler Road
Easton, PA 18040
www.earthworksfirst.com

Net Weight:

50 pounds

22.68 kilograms

Guaranteed Analysis

Total Nitrogen (N) 5.00%
1.30% Ammoniacal Nitrogen
2.70% Water Insoluble Nitrogen*
1.00% Other Water Soluble Nitrogen**
Available Phosphate (P_2O_5). .4.00%
Soluble Potash (K_2O) 5.00%
Calcium (Ca) 7.25%
Sulfur (S) 3.10%
3.10% Combined Sulfur (S)

Derived from: Composted poultry manure, rock phosphate, sulfate of potash, ammonium sulfate and methylene urea.

* 1.45% water insoluble nitrogen from composted poultry manure
1.25% water insoluble nitrogen from methylene urea.

** .70% water soluble nitrogen from composted poultry manure
.30% water soluble nitrogen from methylene urea.

Suggested Spreader Settings
5-4-5 Standard Grade

Spreader	Spread Width	Nitrogen in lb/1000 sq ft	
		0.5	1.0
Spyker	12'	6.8	8.4
Scott's R8-A (cone 8)	10'	N	R ½
AccuPro 2000 (cone 8)	10'	O	T ½
Vicon	28'	50	71
Lely	25'	8.25	10

These settings were calibrated and field tested. Age, condition of spreader, speed of operator and evenness of terrain may require adjustment of setting for desired coverage.

Vicon spreader settings are based on 540 rpm and a ground speed of 4.7 mph.

Lely spreader settings are based on 425 rpm and a ground speed of 4.7 mph.

EarthWorks® 5-4-5
Replenish
Standard Grade

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Pull narrow tape to open

EarthWorks®

5-4-5

Replenish

Standard Grade

Covers 5,000 square feet
at 1/2 lb Nitrogen per 1000 sq ft

Prilled

Net Weight:

50 pounds

22.68 kilograms

FINISH GRADE BELOW SOD. ON TOP OF FINISH MULTI-PURPOSE.

EarthWorks® 5-4-5
Replenish
Standard Grade

Myco-Replenish

3-3-3 Organic Fertilizer with Mycorrhizae

#9 IM WALKER GORDON

Myco-Replenish combines the high quality of EarthWorks Replenish natural organic fertilizers with root stimulating endo and ecto mycorrhizae fungi. **Myco-Replenish** is ideal for any landscape planting situation, establishment of grass seed or sod and will enhance all soil aerification practices. An extensive amount of Mycorrhizae fungi in combination with the known value of the Replenish compost fertilizer will help to promote extensive root growth, reduce heat and drought stress, improves water and nutrient uptake and can eliminate transplant shock.

The word "mycorrhizae" literally means "fungus-roots" and defines the close mutually beneficial relationship between specialized soil fungi (mycorrhizal fungi) and plant roots. About 95% of the world's land plants form the mycorrhizal relationship in their native habitats. It is estimated that mycorrhizal fungi filaments explore hundreds to thousands more soil volume compare to roots alone.

Mycorrhizal fungi increase the surface absorbing area of roots 10 to 1,000 times, thereby greatly improving the ability of the plant to use the soils resources. Several miles of fungal filaments can be present in the thimbleful of soil. But mycorrhizal fungi increase nutrient uptake not only by increasing the surface absorbing area of the roots, but also release powerful enzymes into the soil that dissolve hard-to-capture nutrients, such as phosphorous, magnesium and other "tightly bound" soil nutrients. This extraction process is particularly important in plant nutrient and explains why non-mycorrhizal plants require high levels of fertility to maintain their health.

When combined with the carbon rich food source of Replenish fertilizers the **Myco Replenish 3-3-3** has the energy to take off and perform.

Dry Organics

Myco-Replenish

MIMIC SEED. & APPROACH. - ROOT ZONE

Dry Organics:

- *Replenish Compost*
- *Endo Mycorrhizae*
- *Ecto Mycorrhizae*
- *Humic Acids*

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800-732-8873 Fax: 610-250-7840

SOIL AMEND IN LIEU OF COMPOST & PHOSPH.

Myco-Replenish

3-3-3 Organic Fertilizer with Mycorrhizae

EarthWorks Dry Organics the key to success when building a healthy environment.

Myco-Replenish 3-3-3 Guaranteed Analysis

Total Nitrogen (N)	3%
Water Insoluble Nitrogen	2.1%
Water Soluble Nitrogen	0.9%
Available Phosphorous (P_2O_5)	3%
Soluble Potash (K_2O)	3%
Calcium (Ca)	6%
Iron	0.2%

Plant Nutrients Derived From: Composted Poultry Manure

Contains Endo Mycorrhizae

Endomycorrhizal fungi: 750 propagules per pound:
Glomus intraradices, Glomus etunicatum
Glomus mosseae, Glomus aggregatum

Contains Ecto Mycorrhizae

Ectomycorrhizal fungi: 2,750,000 propagules per pound:
Pisolithus tinctorius, Scleroderma cepa
Scleroderma citrinnum, Rhizopogon villosullus
Rhizopogon luteolus, Rhizopogon amylopogon
Rhizopogon fulvigleba

Application Rates & Programs

TURF:

Aerification: Apply 10 -15 pounds per 1,000 sq. ft.

Sod: Apply 10 pounds per 1,000 sq. ft. as a soil prep.

Seed: Apply 15 pounds per 1,000 sq. ft. of seeded area worked well into the soil.

PLANTINGS:

Mix with the soil being used to fill the planting hole at the rates shown:

Trees: ½ pound (1 cup) for every 1" diameter of trunk.

Shrubs: For one gallon containers use ¼ pound (1/2 cup) mixed thoroughly. For five gallon containers use 1 pound (2 cups) of product mixed with soil.

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Renovate/*Plus*

Recovery Amendment

EARTHWORKS NATURAL ORGANIC PRODUCTS, INC.

A 50:50 BLEND OF RENOVATE AND ECO-LITE

Renovate/*Plus* is an Ideal Amendment for:

GOLF COURSE GREENS AERIFICATION	RECOVERY OF "DEAD SPOTS"
SODDING AND SEEDING PROJECTS	NEW CONSTRUCTION
SPORTS TURF RECOVERY	BIOLOGICAL REPLENISHMENT
LANDSCAPE PLANTINGS	DIVOT MIX

Renovate/*Plus* is the combination of EarthWorks **Renovate** and **Eco-Lite** and is a powerful amendment that will open tight soils, speed turf recovery, and stimulate soil biology without a big nitrogen push. This combination allows for oxygen movement through the soil and promotes an active microbial generated nitrogen cycle. This product is ideal for numerous projects on the golf course or sports field and can "save" those hard to grow areas. **Renovate/*Plus*** is the combination of all the raw materials found in The EarthWorks "Construction Program" which has been a huge success since the early 1990's, and has been the amendment program of choice for hundreds of golf courses as well as professional sports stadiums and other athletic fields. **Renovate/*Plus*** encourages quick recovery of "dead spots," is the ideal product to put under any sod job, and can replace multiple aerification products to simplify those projects and significantly increase their success rate. **Renovate** is a blend of organic and mineral amendments including kelp meal, compost and humic acids which make up a sustainable microbial food source of short, medium and long chained carbons. The diversity of ingredients allows for a quick jump-start of soil activity, but one that will also be sustainable. The mineral fraction of **Renovate** includes greensand, sul-po-mag, hard and soft rock phosphate, and calcium. This combination prevents de-mineralization of the soil and allows for roots to take up nutrients as needed, and is a great way to provide a biological foundation to any soil by promoting soil flocculation and turf recovery. **Eco-Lite** is the premier zeolite rock mineral mined from an exceptionally clean zeolite mine and provides an array of physical benefits including the highest CEC of all physical amendments. Zeolites are very hard rock minerals that possess a crystalline structure and have the capability to absorb water when the surrounding soil is wet, creating better air movement in the soil and allowing for the controlled release of this water when moisture levels in the soil fall. Perhaps the greatest difference between **Eco-Lite** and other physical amendments is its affinity to hold both ammonium nitrogen and potassium, allowing for both nutrients to be more available to the plant over a longer period of time.

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SOIL AMEND FOR COMP. &

Available in 50 lb bags and 2000 # super sacks

RENOVATE
Plus
ECO-LITE

Ecolite - zeolite
Kelp Meal
Greensand
Compost
Hard Rock Phosphate
Soft Rock Phosphate
Humic/Fulvic Acids
Sul-Po-Mag

Renovate/*Plus*

Recovery Amendment

Renovate/*Plus* has a multitude of applications on golf courses, sports turf and landscaping situations. A combination of EarthWorks **Renovate** and the physical amendment **Eco-Lite,** this product can assure the success of sod jobs, improve aerification projects, help recover worn out dead spots and is an ideal divot mix and planting amendment. **Renovate/*Plus*** is formulated from the following amendments in order of volume:

Eco-Lite™: A Zeolite rock mineral mined from the cleanest known mine in New Mexico. Eco-Lite provides numerous benefits to the soil profile. First and perhaps most significantly, this mineral has the highest CEC value of any popular physical amendment ~ as much as three times higher than calcined clays and diatomaceous earth. Eco-Lite also has a very high water holding capacity which allows excess water to be pulled into its crystalline structure to dry up wet soils but allowing for its release osmotically as water pressure drops outside the mineral structure. This phenomena also explains how this mineral can create more air pore space. The most unique benefit from Eco-Lite is its strong affinity to hold ammonium and potassium while not having the same affinity for sodium. Eco-Lite becomes a sustainable mineral form of potassium preventing the leaching of more soluble forms.

Dry Kelp Meal: A very digestible food source for micro-organisms. Rich in over 60 minerals, 21 Amino Acids and 12 Vitamins, ascophyllum nodosum is also a rich source of plant gibberellins and cytokinins which act as plant growth regulators. Kelp extract also provides polysaccarides, which are complex sugars, which along with its vitamins, minerals and amino acids greatly assists in the feeding of soil beneficial micro flora.

Greensand: A potassium silica rock mineral rich in sustainable and available potassium, iron and many other trace nutrients. This is a mica like rock mineral that holds it own weight in water and is an excellent soil conditioner.

Compost: Rich compost, produced on Amish farms in Pennsylvania, provides a stable form of carbon and minerals. Produced from stabilized manures, this product has gone through two digestions, producing an extremely biologically active material and a readily available food source for beneficial micro-organisms.

Hard Rock Phosphate: This is the mineral that is acidified to create the commonly used soluble phosphorous fertilizers. There are studies that show this sustainable rock mineral to be as available as its soluble counterparts when chemical tie-up is taken into account. It is used as a very sustainable form of phosphorus; one that organic acids produced by plant root systems can digest when phosphorus is needed.

Soft Rock Phosphate: A colloidal form of phosphorus. This mineral is available over a wider range of soil pH and provides a certain solubility not found in its hard rock counterpart.

Humic acid and Fulvic acids: An alkaline extract of geologically concentrated humus, rich in organic acids that stimulate beneficial soil fungi, act as chelating agents for micro-nutrients and perform as sequestering agents to help fracture bonds between phosphorus and iron/calcium/aluminum.

Sul-Po-Mag: A mineral that provides the soil with needed sulfur, potassium and magnesium as well as a host of other trace nutrients. Magnesium is a very important nutrient in the photosynthesis process. This mineral is a very good soil conditioner and is fairly soluble.

APPLICATION RATES:

Apply 25-50 lbs./1000 sq. ft. preferably in combination with aeration or worked into the top few inches of soil. Lighter top dressings can also be very beneficial. Continued use is important especially on heavily compacted and biologically weak soils or sand based soils.

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Designation: F 2396 – 04

Standard Guide for Construction of High Performance Sand-Based Rootzones for Sports Fields[1]

This standard is issued under the fixed designation F 2396; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide covers techniques that are appropriate for the construction of high performance sand-based rootzones for sports fields. This guide provides guidance for the selection of materials, including soil, sand, gravel, peat, and so forth, for use in designing and constructing sand-based sports turf rootzones.

1.2 Decisions in selecting construction and maintenance techniques are influenced by existing soil types, climatic factors, level of play, intensity and frequency of use, equipment available, budget and training, and the ability of management personnel.

1.3 This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This guide is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "standard" in the title of this document means only that the document has been approved through the ASTM consensus process.

1.4 The values stated in SI units are to be regarded as the standard. The values in parentheses are for information only.

1.5 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

C 131 Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

C 1444 Test Method for Measuring the Angle of Repose of Free-Flowing Mold Powders

D 422 Test Method for Particle-Size Analysis of Soils

D 653 Terminology Relating to Soil, Rock, and Contained Fluids

D 698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3(600 kN-m/m^3))

D 1883 Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils

D 1997 Test Method for Laboratory Determination of the Fiber Content of Peat Samples By Dry Mass

D 2944 Test Method of Sampling Processed Peat Materials

D 2974 Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D 2976 Test Method for pH of Peat Materials

D 2980 Test Method for Volume Weights, Water-Holding Capacity, and Air Capacity of Water-Saturated Peat Materials

D 3080 Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions

D 4427 Classification of Peat Samples by Laboratory Testing

D 4972 Test Method for pH of Soils

F 1632 Test Method for Particle Size Analysis and Sand Shape Grading of Golf Course Putting Green and Sports Field Rootzone Mixes

F 1647 Test Methods for Organic Matter Content of Putting Green and Sports Turf Root Zone Mixes

F 1815 Test Method for Saturated Hydraulic Conductivity, Water Retention, Porosity, Particle Density, and Bulk Density of Putting Green and Sports Turf Root Zones

F 2060 Guide for Maintaining Cool Season Turfgrasses on Athletic Fields

F 2107 Guide for Construction and Maintenance of Skinned Areas on Sports Fields

F 2269 Guide for Maintaining Warm-Season Turfgrasses on Athletic Fields

[1] This guide is under the jurisdiction of ASTM Committee F08 on Sports Equipment and Facilities and is the direct responsibility of Subcommittee F08.64 on Natural Playing Surfaces.

Current edition approved Dec. 1, 2004. Published January 2004.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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3. Terminology

3.1 *Definitions*—Except as noted, soil-related definitions are in accordance with Terminology D 653.

3.1.1 *clay*—clay can be defined in terms of a particular size fraction of a soil, a soil textural class, a soil particle size class, a soil textural group, soil mineralogy, or, in engineering terms, as materials that exhibit plastic soil properties when at appropriate water contents (**1, 5, 6**).[3]

3.1.1.1 *Discussion*—Ideally, the term "clay" should be appropriately defined when used to describe soils or materials for rootzones. For example, a 90 % sand/10 % clay mixture could imply either 90 % sand/10 % clayey soil (or other soils with textures containing enough clay (<0.002 mm) to exhibit plasticity) or 90 % sand (2 to 0.05 mm)/10 % clay (<0.002 mm).

3.1.1.2 *clay—(1) as a particular size fraction of a soil*; a soil separate consisting of particles <0.002 mm (fine earth fraction) in equivalent diameter; *(2) as a textural class*; soil material that contains 40 % or more clay, <45 % sand and < 40 % silt; *(3) as a soil particle size class*; soil material that contains 35 % or more clay, (clayey soils); *(4) as a soil textural group*; soil material that falls within the textural classes of "sandy clay," "silty clay," and "clay (clayey soils);" *(5) in terms of mineralogy*; soil particulates that are commonly occurring but not restricted to the <0.002 mm fraction (clay minerals). Commonly occurring in soil mineralogy classes as smectitic, kaolinitic, illitic (micaceous), gibbsitic, ferritic, or mixed. Soil mineralogy classes are defined predominantly by the type of soil mineral dominating (40 % or more) the fine earth fraction; and *(6) in engineering terms*; soils containing enough soil material in the less than 0.4 mm fractions such that, when moist, they exhibit consistent characteristics of "moderately plastic" or "very plastic," forming a roll 4 cm or longer and 4 mm or thinner that supports its own weight (**1, 2, 3**).

3.1.2 *saltation*—a particular type of momentum-dependent transport involving: *(1)* the rolling, bouncing or jumping action of soil particles 0.1 to 0.5 mm in diameter by wind, usually at a height <15 cm above the soil surface, for relatively short distances; *(2)* the rolling, bouncing, or jumping action of mineral grains, gravel, stones, or soil aggregates affected by the energy of flowing water; and *(3)* the bouncing or jumping movement of material down slope in response to gravity (**2**).

3.1.3 *sand*—sand can be defined in terms of a particular size fraction of soil, a soil textural class, a soil particle size class, and a soil textural group.

3.1.3.1 *Discussion*—Although no mineralogy term is associated with the definition of sand, common usage often utilizes the terms "quartz" or "silica" as synonyms for sand. While quartz is the most common silica mineral in soils and in the sand fractions in particular, quartz being a mineral highly resistant to weathering, the synonymy with the term sand is incorrect. A proper mineralogy class for quartz is "siliceous," defined as 90 % or more of the 0.2 to 2.0 mm fraction composed of silica minerals (quartz, chalcedony, or opal) and other extremely durable minerals that are resistant to weathering (**4**).

3.1.3.2 *sand—(1) as a particular size fraction of soil*; a soil separate consisting of particles >0.05 mm and <2.0 mm in equivalent diameter; *(2) as a textural class*; soil material that contains 85 % or more sand, and not more than 10 % clay; *(3) as a soil particle size class*; soil material that contains 70 % or more sand, and not more than 15 % clay (sandy soils); and *(4) as a soil textural group*; soil material that falls within the textural classes of "sand" and "loamy sand" (sandy soils) (**3, 4**).

3.1.4 *gravel*—commonly used to denote spherical, cube-like, or equiaxial aggregate materials with an equivalent diameter >2.0 mm and <7.6 mm. More correctly used, this classification refers to "rock fragments" classed as pebbles in the Glossary of Soil Science Terms (1997) (**3, 6**).

3.1.5 *skinned area*—area on sports fields that, by design, is devoid of turfgrasses or other vegetation; may be entire field or a portion of the field (for example, skinned infield in baseball or softball; skinned base paths in otherwise turfed infield). **F 2107**

3.1.6 *soil*—sediments or other unconsolidated accumulations of solid particles produced by the physical and chemical disintegration of rocks, and which may or may not contain organic matter.

3.1.7 *soil profile*—vertical section of a soil showing the nature and sequence of the various layers as developed by deposition or weathering, or both, or as developed by construction procedures.

3.1.8 *soil texture* (gradation) (grain-size distribution)—proportions by mass of a soil or fragmented rock distributed in specified particle size ranges.

3.1.8.1 *soil textural class*—texture designation based on relative proportions of the various soil separates: sand (2.0 to 0.05 mm in diameter), silt (0.05 to 0.002 mm), and clay (<0.002 mm) (**1, 2, 3**).

NOTE 1—Particle size ranges for sand, silt, and clay as listed above vary somewhat from ranges given in Test Method D 422 and Terminology D 653.

4. Significance and Use

4.1 A dense, uniform, smooth, and vigorously growing natural turfgrass sports field provides the ideal and preferred playing surface for most outdoor field sports. Such a surface is pleasing to the spectators and athletes. A thick, consistent, and smooth grass cover also increases playing quality and safety by providing stable footing for the athletes, cushioning their impact from falls, slides, or tackles, and cools the playing surface during hot weather. Sand is commonly used to construct high performance sports turf rootzone systems. Sand is chosen as the primary construction material for two basic properties, compaction resistance and improved drainage/aeration state. Sands are more resistant to compaction than finer soil materials when played upon within a wide range of soil moisture conditions. A loamy soil that may provide a more stable surface and enhanced growing media compared to sand under optimal or normal conditions will quickly compact and

[3] The boldface numbers in parentheses refer to the list of references at the end of this standard.

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deteriorate in condition if used in periods of excessive soil moisture, such as during or following a rainy season. A properly constructed sand-based rootzone, on the other hand, will resist compaction even during wet periods. Once compacted, sands are easier to decompact with the use of mechanical aeration equipment. Even when compacted, sands will retain an enhanced drainage and aeration state compared to native soil rootzones under the same level of traffic. As such, sand-based rootzones are more conducive to providing an all-weather type of playing surface. Properties of both the soil and grass plants must be considered in planning, constructing, and maintaining a high quality sports turf installation. Turfgrass utilized must be adapted to the local growing conditions and be capable of forming a thick, dense, turf cover at the desired mowing height. Unvegetated sand in and of itself is not inherently stable; therefore, it is imperative that grasses with superior wear tolerance and superior recuperative potential are utilized to withstand heavy foot traffic and intense shear forces. Sand does, however, have incredible load bearing capacity and if a dense, uniform turf cover is maintained, the sand-based system can provide a very stable, firm, smooth, and uniform playing surface. A successful sand-based rootzone system is dependent upon the proper selection of materials to use in the project. The proper selection of sand, organic amendment, soil and gravel is of vital concern to the performance of the system and this guide addresses these issues.

4.1.1 During construction, consideration should be given to factors such as the physical and chemical properties of materials used in the area, freedom from stones and other debris, and surface and internal drainage.

4.1.2 Maintenance practices that influence the playability of the surface include mowing, irrigation, fertilization, and mechanical aeration and are factors addressed in other standards (see Guides F 2060 and F 2269).

4.2 Those responsible for the design, construction, or maintenance, or a combination thereof, of natural turf athletic fields for high-performance, all-weather purposes will benefit from this guide.

4.3 A successful project development depends upon proper planning and upon the selection of and cooperation among design and construction team members. A high-performance, sand-based rootzone project design team should include a project designer, an agronomist or soil scientist, or both, and an owner's representative. Additions to the team during the construction phase should include an owner's project manager (often an expansion of role for the owner's representative), an owner's quality control agent (often the personnel that is employed in advance with the intent of becoming the finished project's sports field manager), an owner's testing agent (often an expansion of roles for the project's agronomist/soil scientist), and the contractor.

4.3.1 Planning for projects must be conducted well in advance of the intended construction date. This often requires numerous meetings to create a calendar of events, schedule, approvals, assessments, performance criteria, material sourcing, geotechnical reports, and construction budgets.

NOTE 2—Other specifications on soils for athletic field construction have been published and have been considered during the development of this guide.

5. Construction

5.1 The steps to be used in construction of a new athletic field include:

5.1.1 Survey and stake the site to establish subgrade and finish grade elevations.

5.1.2 Construct and prepare subgrade, and provide a correct and certified subgrade.

5.1.3 Install subsurface drainage system, frame out warning tracks, skinned areas, and so forth, as appropriate.

5.1.4 Install irrigation system (irrigation system may be installed prior to rootzone installation).

5.1.5 Prepare for rootzone installation.

5.1.5.1 Secure suitable sand, properly tested and approved.

5.1.5.2 Blend any amendments with sand to project specifications, approve using QC program.

5.1.5.3 Install approved gravel (if included in design).

5.1.6 Install rootzone blend.

5.1.7 Bring field to final grade and contour in accordance with specifications, compact to specifications.

5.1.7.1 A pre-plant fertilizer application may be applied at this point as specified.

5.1.8 Establish turf by appropriate methods (seed, sprigs, plugs or sod).

5.1.9 Fertilize the installation as appropriate based upon soil testing.

5.1.10 Turf is to be established based upon grow-in recommendations from a competent agronomist or soil testing laboratory, as appropriate for the turf species utilized and the climate of the site.

5.2 *Survey and Stake*—This procedure should be done to conform to the project designer's specifications as appropriate for the sport. In the case of the construction of a replacement field, this step may be deleted or modified as appropriate. Care should be taken to protect staking during the construction process.

5.3 *Construct and Prepare Subgrade*—Contour the subgrade in accordance with specifications at a suggested tolerance of ±25 mm (1 in.) within 3 m (10 ft) of linear direction as specified in 5.5.6. The subgrade should be installed at a depth such to accommodate the final profile depth of rootzone and any gravel layer (if included). The subgrade should be compacted sufficiently (suggested 85 % minimum to 90 % maximum proctor density) to prevent future settling. Subgrade should be designed to conform to surface contour of finished playing surface.

5.4 *Subsurface Drainage System*—Many types of designs exist for subsurface drainage most commonly including a grid or herringbone pattern. The project specifications should include a subsurface drainage design to facilitate drainage for a 25 year storm event. Most commonly used drainage systems for sand-based athletic fields include utilizing perforated drainlines 10 cm (4 in.) in a 4.5 m (15 ft) to 6 m (20 ft) spacing between drainline laterals.

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5.4.1 *Drainline Trenches*—Trenches constructed for drainlines should be excavated into a properly prepared, graded, and compacted subgrade. Drainage trenches should be of a depth such to conform to the drainage contours. All drainage trenches and drainline installations should maintain a minimum positive slope gradient of ≥0.5 % toward drainage outlets with trench bottoms compacted to subgrade specifications. Drainage excavations should be made such that a minimum of 5 cm (2 in.) of bedding material can be contained around the installed drainline (below, to each side, and above). For example, a 10 cm (4 in.) diameter drainline installation will require a minimum dimension of 20 cm (8 in.) wide by 20 cm (8 in.) depth (for example, 10 cm drainline + (5 cm/side × 2 sides) = 20 cm; 10 cm drainline + 5 cm top + 5 cm bottom = 20 cm). Once drainage trenches are excavated, all excavated material should be removed from the subgrade surface and disposed off site. The subgrade should have no elevations of subgrade soil material such to hinder the flow of water along the subgrade interface into the drainage trench. Once drainage trenches have been excavated, the trench bottoms should be sufficiently compacted to the subgrade compaction specifications prior to installation of drainage system. Subgrade shall be re-surveyed and certified prior to gravel or rootzone import.

5.4.2 *Surface Drainage*—To maintain adequate surface drainage, all field installations should include a minimum of 0.5 % slope gradient (simple slope or crown) to remove water off of the playing field in case of a storm event with severe rainfall intensity and to facilitate the use of tarps. It is recommended that an adequate number of small size surface drainage inlets be installed in the perimeter of the installation (in out-of-play areas) and tied into the drainage collection system for removal of surface runoff with the subsurface drainage water.

NOTE 3—In planning and designing projects, consideration shall be given to the permeability of the rootzone when determining the slope of the finished surface and the need for adjacent surface drainage systems. Further consideration shall be given in cold climates where frost penetration may impact the permeability of the rootzone when determining the slope of the finish surface and the need for adjacent surface drainage systems. Generally, the need for improved surface drainage increases as the permeability of the rootzone decreases.

5.4.3 *Sub-Surface Drainage Material*—Three recommended options exist for the use of drainage material. Option 1 could utilize sand rootzone material to backfill around drainlines within the drainage trenches. Option 2 could utilize gravel material to backfill around drainlines in the drainage trenches. Option 3 could include the use of gravel to backfill around drainlines in drainage trenches and to form a drainage layer overlying the subgrade before placement of rootzone sand blend. All backfill treatments shall be compacted to specifications prior to further installation procedures. It is recommended that backfill for trench bottoms is installed and compacted prior to installing drain pipe into the trenches. It is recommended that the trench bottom remain unobstructed as installed and no soil pilings, wood blocks, concrete or metal blocks are used to adjust and maintain slope of drainlines. Any blocks used for this purpose must be removed from under the drainlines and any cavities backfilled before proceeding. It is recommended that drainage trenches (bottom and sides *only*) should be lined with a woven geosynthetic filter fabric to prevent contamination (lateral movement of subgrade materials into trench fill). Geosynthetic filter fabric should *not* be used to cover the drainage trench. It is recommended that all drainlines are installed straight (without 'snaking') within the trenches. It is recommended that sleeves (of oversize PVC piping) should be installed across the drainage trenches at appropriate points as indicated by the irrigation design to facilitate irrigation pipe installation at points where the irrigation line crosses over the drainage trenches.

TABLE 1 Gravel Filter/Drainage Layer Specifications (7, 8)

Performance Factor	Criteria	Acceptable Value
Filtering Factors	D_{15} of gravel/D_{85} of rootzone mix	<5
	D_{50} of gravel/D_{50} of rootzone mix	<25
Permeability Factor	D_{15} of gravel/D_{15} of rootzone mix	≥5
Uniformity Factors	D_{60} of gravel/D_{15} of gravel	≤2.5
	>12 mm fraction	0 %
	<2 mm fraction	≤10 %
	<1 mm fraction	≤5 %

5.4.3.1 *Option 1*—Rootzone sand (with or without other rootzone amendments) may be utilized to backfill around drainlines. If sand is utilized for this purpose, the drainage pipe used in these installations must be of a type that utilizes slitted perforations with slit openings meeting a specification of D_{85} sand/slot width >1.5, to reduce the potential for particle migration into the drainage system (7).

5.4.3.2 *Option 2*—Gravel may be used for backfill of drainage trenches. If gravel is used for backfill, it should conform to the specifications in Table 1. Soft gravel minerals (such as limestone, sandstone, or shale) are not acceptable for use and all questionable gravel material should be tested for weathering stability using the sulfate soundness test (see Test Method C 88). A loss of material greater than a 12 % by weight is unacceptable. Likewise, any gravel material that is suspect in its mechanical stability should be tested utilizing the LA Abrasion test (see Test Method C 131). An LA Abrasion test value greater than 40 is unacceptable.

5.4.3.3 *Option 3*—Gravel may be used to backfill drainage trenches and to form a drainage layer beneath the sand rootzone. If gravel is used for this purpose, the same gravel should be used for backfill and the drainage layer, and should conform to the specifications given in Table 1. Soft gravel minerals are not acceptable for use and all questionable gravel material should be tested for weathering stability using the sulfate soundness test (see Test Method C 88). A loss of material greater than 12 % by weight is unacceptable. Likewise, any gravel material that is suspect in its mechanical stability should be tested utilizing the LA Abrasion test (see Test Method C 131). An LA Abrasion test value greater than 40 is unacceptable. A gravel drainage layer should be a minimum of 7.5 cm (3 in.), with 10 cm to 15 cm (4 to 6 in.) preferred. During installation, the gravel is typically dumped from the delivery trucks onto the perimeter, and then distributed over the construction site by a small, tracked, crawler tractor (or similar), being careful to avoid driving over and crushing the drain lines. Contour and compact the gravel in accordance with

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specifications at a suggested tolerance of ±12.5 mm (½ in.) within 3 m (10 ft) of linear direction and as specified in 5.5.6.

5.4.3.4 *Discussion*—If gravel is utilized as a drainage layer, it will improve the drainage of the system under conditions of saturated flow only. Saturated flow conditions typically only occur during intense or prolonged rainfall events. Under unsaturated conditions, the use of a gravel layer will impede drainage and will serve to retain additional moisture within the rootzone profile. This condition is commonly referred to as a 'perched' or 'suspended' water table. The water perched in the rootzone at the interface with the gravel will be retained in a condition nearing saturation. While such conditions may be beneficial in terms of water conservation, care must be exercised in the design of the rootzone system, such that excessive moisture is not retained that could lead to anaerobic rootzone conditions. Such conditions are common on poorly designed gravel, underdrained, sand-based rootzone systems. If a gravel underdrain system is used, the design parameters should be adjusted to assure a minimum of 15 cm (6 in.) of well aerated rootzone. If the capillary rise of salts or other contaminants from the subgrade are of concern on a particular project, the use of a gravel layer is recommended to prevent this occurrence.

5.4.3.5 *Determination of Well-Aerated Rootzone Conditions*—A well-aerated rootzone is normally that portion of the rootzone that retains ≥20 % air-filled porosity (AFP) after gravitational drainage ceases (as determined at 40 cm tension). To determine the depth of sand required to obtain the desired well-aerated profile depth, a soil moisture retention curve of the rootzone material must be determined. Considering that the perched water above a gravel layer will be retained at a tension of approximately 10 cm tension, the moisture retention status of the rootzone material should be considered at tensions greater than 10 cm until the proportion of air-filled pores within the rootzone material reaches 20 % or greater. For example, let's hypothesize that a soil moisture retention curve shows that a material reaches 20 % AFP at 21 cm tension. To provide a 15 cm well-aerated rootzone, our profile depth would be 21 cm (AFP threshold tension) – 10 cm (tension of perched water) + 15 cm of well-aerated rootzone, for a total rootzone depth of 26 cm. Moisture retention points should be determined utilizing methodologies in Test Method F 1815.

5.5 *Sand-Based Rootzone*—Materials used to provide the sand for the rootzone shall meet the performance criteria established in this guide. Additions of peat or soil, or both, may be included in small proportions as part of the rootzone blend, if the inclusion of these materials will not bring the resulting blend out of specifications and if they are uniformly blended together to form a homogeneous blend.

5.5.1 *Sand Type*—Quartz sands are recommended; if sand contains more than 5 % calcium carbonate equivalent, the sand has the potential for particle cementation due to dissolution and reprecipitation of carbonates. Other sands are not recommended due to their propensity to weather (by either mechanical or chemical means, or both) over a relative short period of time (1 to 5 years) that may influence the performance of the construction. For example, granitic material often contains appreciable amounts of feldspar or mica which is much more readily subject to weathering. Caution should be given to sands that contain appreciable proportions of mica minerals. Mica grains have a flat or plate-like morphology and redistribution of these grains with a rootzone profile may create layers that impede drainage and aeration.

TABLE 2 Recommended Particle Size Distribution of Rootzone Sand[A]

Size Fraction	Particle Diameter Range	Specified Range (%)
Gravel	>4.75 mm	0 %
Gravel	3.4 to 4.75 mm	<5 %
Fine gravel	2.0 to 3.4 mm	<20 %
Very coarse sand	1.0 to 2.0 mm	<20 %
Coarse sand	0.5 to 1.0 mm	25 to 50 %
Medium sand	0.25 to 0.5 mm	>25 %
Fine sand	0.15 to 0.25 mm	<10 %
Very fine sand	0.05 to 0.15 mm	<5 %
Silt	0.002 to 0.05 mm	<5 %
Clay	<0.002 mm	<3 %

[A] See 5.5.2.1-5.5.2.4 for additional recommendations.

5.5.2 *Particle Size Distribution*—Particle size analyses (Test Methods D 422 or F 1632) are based on oven-dried mass of a weighed sample; shaker is the preferred method of dispersion to prevent fracturing of sand particles that may falsely influence the sand size distribution. There are many published specifications within the turf industry for sand size distribution for sand-based rootzone constructions. Many of these specifications are primarily intended for golf green construction. As such, the amount of coarse material allowed is limited in order to produce a very smooth surface under extremely short mowing conditions to facilitate smooth roll of the small golf ball. Such conditions are not required for athletic field construction and the use of higher proportion of coarser sand material can be utilized. Table 2 includes a recommended sand particle size distribution (before amendments), but is not inclusive of all size distributions of sands that could be used to produce a high performance sand-based field. Additionally:

5.5.2.1 No more than 30 % in the combined very coarse sand, fine gravel, and gravel fractions.

5.5.2.2 At least 60 % of the total sand should be in the combined medium sand and coarse sand fractions.

5.5.2.3 No more than 15 % in the combined fraction less than 0.25 mm (fine sand, very fine sand, silt and clay fractions).

5.5.2.4 A Coefficient of Uniformity ($CU = D_{60}/D_{10}$) value of 2.5 to 4.5.

5.5.3 *Sand Shape*—Although acceptable sand-based rootzones can be constructed with sands of all shapes, this factor is worth consideration in athletic field construction. Sand shape is generally classed as to angularity and sphericity. Angularity includes well-rounded, rounded, subrounded, subangular, angular, and very angular. Sphericity includes high sphericity, medium sphericity, and low sphericity. Sand shape should be classified according to Figure 1 of Test Method F 1632. While no sand will have sand grains of uniform shape, there is normally a predominant shape of grains from a single sand source. The shape and dimension of sand grains affect its stability. For example, rounded grains are the least stable because of the lack of edges to interlock the grains. As such the sand grains tend to act like small ball bearings. Angular sands to have greater stability because the sharper edges have a

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greater grain-grain interlock and resistance to shear. Sands that have a predominance of grains that show extremes in angularity (extremely angular or extremely round) that fit outside the classification in Test Method F 1632 should be avoided. Likewise, extremely high or low sphericity particles should be avoided, including plate-like particles. Many dune sand sources may contain sand grains that have internal fracture planes. During the saltation process, dune sands can become rounded as they roll and skip along the surface as a function of the wind. However, during strong wind events, the grains can be moved at a high velocity, whereby the grains impacting upon each other develop 'cracks' or fracture planes within the grain. When rootzones are constructed with these sands, traffic and other weathering factors may cause the grains to fracture along these planes, resulting in the formation of silt-size quartz grains which may then be prone to particle migration and subsequent accumulation in layers. Sand grains should be examined under 20 to 50× magnification for sand size, shape, and potential fracture planes.

5.5.4 *Rootzone Amendments*—Two types of amendments are commonly included in a blend with sand that together make up the rootzone material. This would most commonly include a blend with soil or peat, or both.

5.5.4.1 *Soil*—Soil is commonly used as a component of a sand-based rootzone construction in order to provide some enhanced capacity for moisture and nutrient retention and sometimes to improve the mechanical stability of the rootzone. Proportions of soil in a high performance rootzone mix typically range from 5 to 15 % by volume. The amount of soil to include in a blend depends upon the make-up of the soil component, and the effects of the soil additions to the physical performance characteristics of the resulting blend. Ideally, the soil component would be one that is composed purely of clay. Clay minerals generally have good moisture and nutrient retention capacities, and if present in high enough proportions may significantly improve rootzone stability by enhanced cohesive properties. When clay is included in a blend with sand in the appropriate proportion, the clay will coat the sand and form bridges between sand grains without clogging up the large pores (interstitial pores or packing voids) of the sand matrix. If a pure clay source is used, many sands will accommodate 10 to 15 % clay additions without clogging. However, care must be used in the blending and preparation process because a small increase in clay content can cause a drastic detrimental change in the performance of the rootzone. This is a primary reason for a well-designed calibration and quality control program. Other soils may be used as a component of a sand-based rootzone blend, but should be restricted to those soil textures that are low in silt content. Silt is normally a fine-grained, non-plastic soil material and is subject to migration and layering. Soils that exhibit a silt to clay ratio greater than 2 should not be used. Likewise, those soils with a fines (silt + very fine sand + fine sand) to clay ratio greater than 3 should be avoided. Generally, soils containing more than 6 % organic matter should not be used, nor any mucky-type soils. Peat may be used to increase the organic matter content in a three-way blend of sand-soil-peat.

TABLE 3 Suitability Ratings of Properties of Organic Amendments for Utilization in High Performance Sand-based Athletic Field Rootzones

Rating\Property	C/N Ratio	Ash Content	pH
Preferred	20:1 to 30:1	<12 %	4.5 to 7.0
Acceptable	30:1 to 50:1	12 to 17 %	3.5 to 4.5
Marginal	50:1 to 80:1	17 to 30 %	3.0 to 3.5
Unacceptable, or use only with caution	<20:1 or >80:1	>30	<3.0 or >7.0

5.5.4.2 *Peat*—Peat is commonly used as an amending source in a sand-based rootzone. Proportions of peat included in a blend (usually 15 to 20 % by volume) should give an organic matter content of 0.3 to 2.0 % by mass. As with soils, peat adds water and nutrient retention capacity, but will add little in terms of increased soil strength (cohesion). Peats can also slow water movement through excessively drained sands. Finer peats, whether by decomposition or by finer grinding, generally have a greater effect on slowing water movement. Three sources of peat have been used successfully to modify sands. They are moss peats (sphagnum and hypnum), reed-sedge peats (derived from reeds, sedges, marsh grasses, and other plants of the wetland), and peat humus, which is decomposed peat (usually derived from moss or reed-sedge sources). Peats to avoid in modifying sands are woody peat (derived from trees and shrubs) and sedimentary peat (derived from plants that grow in water and found on pond and lake bottoms). Peats can be classified according to fiber content (see Classification D 4427). In general, moss peats fall into the fibric classification, which indicates the greatest fiber content; reed-sedge peats into the hemic classification (a mid-range of fiber content); and peat humus into the sapric classification (lowest fiber content). The acceptable sources of peat range in their physical and chemical properties and information in Table 3 can be utilized during the selection of a peat. Fibric peats are characterized by low ash contents, and low volume weights (bulk densities). Because of a lower volume weight, a greater amount on a volume basis than with the other sources will be needed to achieve a desired organic matter content in the blend, which is reported on a mass basis. The low volume weight peats do not mix as readily as heavier peats when being mixed on-site by tillage, but this problem is largely negated by off-site mixing with various blending equipment. Off-site mixing is preferred for high performance sand-based rootzones. The fibric peats decompose more rapidly than hemic and sapric peats; however, their longevity is such that they provide benefits until organic additions from the turfgrass stand contribute significantly to the soil organic matter pool. With sphagnum moss peat, low pH may create the need for lime additions to the mix, and relatively low nitrogen (N) content and wide C/N ratio could lead to N tie-up by microorganisms and the need for additional N fertilization. Potential problems encountered with fibric peats are reduced with hemic peats, which are denser, somewhat lower in acidity, higher in N content, and more readily mixed. Also sapric, or decomposed peats, have fewer problems with pH, N content, and volume weight; however, they contain more ash and some low quality sapric peats may contain mineral soils that result in unacceptably high ash contents. The organic matter in sapric peats,

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already being in a somewhat decomposed state, is more stable than organic matter in the more fibrous peats. Peats considered for inclusion in high performance sand-based rootzones can be classified according to Classification D 4427, and further tested by methods listed in 5.5.5.3. Suggested recommendations for peat/organic amendments for high performance sand-based rootzones are given in Table 3.

5.5.4.3 *Discussion*—Often the use of composts are proposed as substitutes for peat products. While in some instances, composts may produce satisfactory products for inclusion in a rootzone construction, the variability of compost products tends to be much higher than those of natural peat deposits. This variability is especially true over time and from season to season. Composts also typically contain higher ash content, may contain contaminants of soil or other earthy materials, may contain wood, and may not be completely stable in terms of chemical and physical properties. Composts may also contain high elevations of trace metals or salts, or both (although testing can be used to determine the level of these constituents). The use of composts in a high performance sand-based rootzone should be approached with a high degree of caution and employed with thorough quality control in the sourcing and construction phases. Under strict control and testing, composts have and may be used for high performance sand-based rootzone constructions. It is recommended that only compost products be used that have been used successfully in high performance sand-based field mixes in the past, and only in amounts sufficient to meet the performance parameters outlined in this guide. Mix design and testing should be performed by laboratories experienced in evaluating composts and compost amended mixes.

5.5.4.4 *Quality Control (QC) Program*—Every high performance sand-based rootzone should be constructed using a well designed and administered calibration and QC program. Such program should set the parameters to be included in the QC testing, the procedures for sampling, sampling intervals, handling the samples (chain of custody), the limits/tolerances or confidence intervals for accept/reject status within a sample, and the allowable variability of test parameters between samples.

5.5.5 *Rootzone Blending*—Rootzone blending is perhaps the most critical aspect of the construction process. Once amendment ratios are known, the components of the blend should be prepared.

5.5.5.1 *Sand*—The sand should have been previously processed, stockpiled, tested, approved, and quality control tested.

5.5.5.2 *Soil*—Any soil amendments should have been tested and approved and then prepared for blending by first shredding, screening, and the removal of any objectionable stones or other items. Once the soil has been prepared in this manner, the soil should be transported to the blending site for stockpiling. Once the material arrives on site, it should be protected from weather, particularly rain. During the processing and transportation of the soil component, it may be beneficial to mix or homogenize the soil material as much as is feasibly possible. Once homogenized and transported to the blending site, an additional sample should be taken and tested for conformance with the original tested material so that any adjustments in the blending proportions needed to compensate for variance in the soil stockpile may be made. It should be noted that soil components (particularly topsoils) are a potential source of weeds by seeds or plant parts. Consideration for eradication or fumigation of these materials may be warranted.

5.5.5.3 *Peat*—The peat product used for amending the sand should have been tested and approved prior to shipment of material to the blending site. Once the material arrives on site, it should be protected from weather, particularly rain. As peat is unloaded or unpackaged, it should be visually inspected for apparent uniformity within the shipment. If the project owner, project designer, or agronomist is sufficiently familiar with the peat material from past projects, the only QC testing that may be required for the peat is the calibration and QC for organic matter content of the resulting sand-peat mix. If the peat product/source is new or unfamiliar to the project personnel, additional QC tests should be performed at set testing intervals prior to blending. Peat QC test parameters may include ash content, organic matter, pH, fiber content, moisture content and volume weight (see Test Methods D 1997, D 2944, D 2974, D 2976, D 2980, and Classification D 4427) and C/N ratio. The above advice also applies to composts used as organic amendments.

5.5.5.4 *Blending*—The blending operation should only proceed once all of the materials have been tested and approved and transported to the blending site. It is recommended that blending operations proceed off-site as to the installation. Possible blending sites include: *(1)* the location for sand materials supply or stockpile; and *(2)* in an area adjacent to field site (such as a paved parking lot). The materials to be blended should be blended in a slightly moist to moist condition. Excessively wet material will not blend together properly and uniformly. Blending should be performed using commercial soil blending equipment designed for this purpose. The project designer should calculate production to include a minimum of 5 % (10 % preferred) additional rootzone material to account for shrinkage. Any leftover rootzone material could be stockpiled by the owner for use in future maintenance (topdressing) operations and for other repairs. The blending should be initiated with the preparation of a 'batch' for calibration purposes. A calibration batch stockpile is normally composed of a 100 ton minimum. The calibration batch should be sampled and tested to assure the blending equipment is properly calibrated before proceeding further. Each test for calibration may delay the blending operation 24 to 48 h, awaiting test results and recommendations from the testing laboratory. Another option would be to employ a commercial testing agent with the capacity to perform on-site testing with mobile laboratory equipment. The mobile laboratory may be utilized throughout the calibration and blending process to facilitate the logistics of the operation. It is recommended that 1 of 10 tests conducted by the mobile laboratory are duplicated at the regular laboratory facility to assure accuracy of the on-site testing data.

5.5.5.5 *Stockpile Storage and Transportation*—During the blending operation, and once the rootzone material has been blended and all QC approvals have been met, the stockpiled material should be protected against the effects of weather. If

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heavy rain is expected, the stockpiles should be covered, if possible. To protect against wind erosion of soil or organic components, the stockpiles should be kept moist on the surface of the stockpile. Once stockpiled rootzone material is to be transported to the construction site, care should be taken to ensure that the loading equipment and haul vehicles/containers are properly sanitized such to contain no foreign soil, aggregate, asphalt, and so forth that might contaminate the blended rootzone material. When the stockpile material is being picked up for loading, care should be exercised to assure that the bucket of the loading equipment is not picking up underlying soil or asphalt and that cleated tires or tracks are not 'tilling' other material into the rootzone mix.

5.5.6 *Grading Requirements*—All grades should conform to those grades and elevations as specified in the construction documents. The suggested method for grade evaluation and grade tolerances are:

5.5.6.1 For general conformance, perform an as-built survey based upon an 8 m (25 ft) grid to be within:

(1) Subgrade, ±25 mm (1 in.).

(2) Gravel Drainage Layer (if used), ±12.5 mm (½ in.).

(3) Surface/Finish, ±6 mm (¼ in.).

5.5.6.2 For specific conformance and acceptability of grades between grid points (spot check), it is recommended that any observed (or suspected) high and low points be checked using a 3-m (10-ft) straight edge with tolerances based upon:

(1) Subgrade, ±25 mm (1 in.) in any linear direction.

(2) Gravel Drainage Layer (if used), ±12.5 mm (½ in.) in any linear direction.

(3) Surface/Finish, ±6 mm (¼ in.) in any linear direction.

5.5.6.3 Grades shall be correct, certified, and approved (at each phase: subgrade, gravel layer (if used), and finish grade) by the owner or project designer, or both, prior to proceeding to the next phase of construction. Correct and certified grade shall be given by the production of an as-built drawing/diagram depicting elevation and location data that has been prepared and stamped by a licensed surveyor. The certified as-built drawing/diagram shall be submitted for approval to the owner or project designer, or both, as specified in the construction documents prior to proceeding to the next phase of the field construction.

5.6 *Installation*—Installation procedures include the installation of the drainage trench backfill material, installation of any gravel drainage layers, delivery, and installation of the rootzone material, installation of the irrigation, finish grading of the site, and then turf establishment. Rootzone installation depth shall conform to project designer's specifications. Typical rootzone placement depths range from 15 cm (6 in.) to 30 cm (12 in.) for installations without a gravel drainage layer. If a gravel drainage layer is used, the rootzone placement depth must be correlated with the desired depth of well-aerated rootzone. Typically, the profile depth of a sand-based field installed over a gravel drainage layer ranges from 23 cm (9 in.) to 40 cm (16 in.).

5.6.1 *Installation of Drainage Materials*—Drainage trench installation should be completed to the point of backfill and compaction (see 5.4.3) prior to installation of the irrigation system. If a gravel drainage layer is a component of the system design, the installation of the gravel layer should be completed following the rough installation and pressure testing of the irrigation system.

5.6.2 *Installation of the Irrigation System*—Irrigation system shall be designed and installed to provide head to head coverage with uniform distribution (9). Suggested irrigation design uniformity values (CUIRR or Christiansen's coefficient of uniformity) are: *(1)* football, soccer, or other rectangular field designs: ≥90 %; and *(2)* baseball/softball, cricket, or other non-rectangular field designs: ≥84 %. Irrigation pipe should be installed to a depth sufficient to be protected from mechanical aeration maintenance practices. Normally, this would be at a depth of 36 cm (14 in.) or more from finished grade. In the case of shallow profile designs of less than 20 cm (8 in.), the irrigation lateral and mainlines may be installed within the subgrade below the depth of the entire drainage system. The installation of the irrigation lines below the drainage system serves to isolate the irrigation lines from potential damage from aeration or other maintenance practices. Irrigation mainlines and lateral lines (with sleeving, if included) should be installed prior to placement of the gravel drainage layer (if used) or rootzone materials, or both. Irrigation lines crossing drainage trenches may be 'sleeved' across the drainage trench to facilitate subsequent irrigation system installation without disturbing the drainage trench system. Irrigation lines *should not* be installed within the same trenches as the drainage system in order to minimize the disturbance of one system to the other as they are being installed or repaired. The irrigation system mainlines should be pressure checked (24 h static pressure) before backfilling and prior to proceeding with the next construction phase.

5.6.2.1 *Complete Installation of Gravel Drainage Layer*—If a gravel drainage layer is used as a component of the rootzone design, this gravel layer may be installed once the irrigation system rough installation and a pressure check are completed.

5.6.3 *Delivery and Installation of the Rootzone*—The rootzone material should be transported to the site and dumped around the perimeter of the site. A small crawler tractor is ideally suited to spread the rootzone material working from the perimeter inward toward the center of the field. Wheeled tractors or larger tractors may cause excessive pressure that could lead to crushing of the drainage pipes, rutting of the subgrade, or over compaction of the rootzone material. As subsequent rootzone material is moved to the site for dumping, a plywood course should be constructed over the installed rootzone to facilitate the movement of trucks onto the field for dumping of the load. The plywood course not only protects the rootzone from rutting and excessive compaction, but also allows the trucks to deliver their load without becoming stuck in the sand. Under no circumstances should trucks or other equipment be allowed to travel over the uncovered subgrade. Once the delivery of the rootzone material is completed, the field may be shaped, rough-graded, and compacted as specified.

5.6.4 *Final Field Preparations*—Final field preparations include bringing the field to final grade and contour and may include pre-plant fertilization and pre-plant irrigation.

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5.6.4.1 *Finished Grade*—Once the rootzone material has been installed and rough graded, the field should be graded to final (finish) grade and contour. It is strongly recommended that laser guided leveling equipment is specified and utilized for this critical aspect of the construction process. A smooth and uniform grade is a very important aspect of proper conditions for enhanced playability and safety of an athletic field. The specified grade and contour should conform to a ±6 mm (±¼ in.) within 3 m (10 ft) in any lateral distance for general conformance and specific conformance as outlined in 5.5.6. Such tolerances are only achievable with laser-guided equipment. During the finish grade operation, compaction should be achieved by irrigating and rolling the surface utilizing a lightweight roller (less than 2 ton) with at least two passes in perpendicular directions. Finished grade should be within specified tolerances, correct and certified as specified (see 5.5.6) before turf installation.

NOTE 4—In general, as the soil component in a sand-based rootzone increases, rolling should be performed with lighter equipment also giving a higher level of attention to the moisture content of soil component. In any case, it is recommended that when using soil components with an increased potential to compact in a blend with sand, rolling shall be done with caution.

5.6.4.2 *Pre-Plant Operations*—Pre-plant operations may include the use of a pre-plant fertilizer or other soil fertility amendment. Applications can be made as a granular product that is spread across the field or as a liquid application that is sprayed across the field or injected into the irrigation system. Once the pre-plant materials are applied, it may be desirable to lightly irrigate or 'water-in' the applied materials. Any pre-plant operations must be performed with care to avoid rutting or disruption of the final grade in any manner. Only lightweight or walk-behind equipment is advisable.

5.6.5 *Turf Installation*—The turf to be used in the athletic field project should be thoughtfully considered and specified by the project's project designer, owner, or project agronomist. It should be of a species and cultivar adapted to the local climate, capable of withstanding the stresses imposed on an athletic turf, while providing good playability and aesthetic characteristics. Depending upon turf species and cultivar selected, turf installation methods may include seeding, sprigging, plugging, or sodding. Any turf installation methods used must be carried out in a manner that protects the integrity of the finished grade. No heavy machinery such as tractors, hydrospray tanks, or trucks should be allowed on the surface, unless equipped with turf-type tires.

5.6.5.1 *Seeding and Sprigging*—Seeding and sprigging offer the most flexibility of the methods because they do not pose the risk of contamination of the rootzone with attached soil, they can be spread or planted mechanically or by the use of hydroseeding/hydrosprigging. If the project construction timeframe allows, seeding or sprigging are the preferred methods of establishment. Any mechanical sprigging equipment or seeders should be outfitted such to avoid disruption of finished grade. The use of heavy or large hydrosprig/hydroseed equipment intended for use in the hydroseeding or hydrosprigging of roadside and highway landscapes should be avoided, except where the equipment can be kept off the field and the hydroseed/hydrosprig material applied by use of a hose. Seeds or sprigs should be Certified turfgrass seed/sprigs (if available). Seeds or sprigs shall be free of, or below acceptable threshold levels for, objectionable or noxious weeds, foreign turfgrass cultivars, off-types of the same species, insects, nematodes, diseases, or any other objectionable material.

TABLE 4 Sod-soil to Rootzone Sand Compatibility Recommendations

Criteria	Preferred	Acceptable	Marginal	Unacceptable
$D_{50}R/D_{50}S$	<2.5	2.5 to 5.0	5 to 10	>10
Silt and clay (%)	<5	5 to 10	10 to 15	>15
Silt to clay ratio	<2	2 to 5	5 to 7	>7
Gravel (>2 mm) (%)	0	0 to 2	2 to 5	>5

R = Rootzone S = Sod-soil

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5.6.5.2 *Plugging*—Establishment of rapidly growing warm season turf cultivars that propagate by spreading through rhizomes or stolons (for example, seashore paspalum and bermudagrass), may be established by plugging. Plugging has some distinct advantages as an establishment method. Installed plugs have an established root system, and therefore are not as subject to stresses of drought should an interruption in water supply occur, or if limited water quantities are available for irrigation. If the growing medium of the plugs was a 'soil-less' mix, then minimum contamination of the rootzone can be expected. Plugs can be planted on a wide variety of spacings, depending upon the desired rate of grow-in desired and the turf cultivar utilized. Typical plug planting spacing ranges from 20 cm (8 in.) to 40 cm (16 in.) on center. Plugs should be free of weeds, contaminants, off-type turf, or any other objectionable material. Plugs for athletic fields are best planted by hand. Another method of plug establishment is sometimes utilized whereby a mechanical planter processes sod into irregular pieces and then plants them as 'plugs.' This method of plugging irregular sod pieces may also be used for satisfactory establishment of turf and can be done mechanically with due caution to avoid disruption or rutting of the finished grade.

5.6.5.3 *Discussion*—Plugging as used in this guide defines the use of discreet media-rooted turf plugs (as often coming in a plastic media tray). This method of plugging should not be confused with the practice of planting irregular sod pieces, which is also referred to as plugging in some areas. Plugging by the use of irregular sod pieces is a practice more closely resembling a sprigging operation and the establishment of turf by this practice should conform to the specifications as given for mechanical sprigging.

5.6.5.4 *Sodding*—Sodding offers the quickest establishment of any turf installation method. Sod can come in rolls or slabs of various dimension and thickness. If sod is to be used, it is preferable to wash the soil from the sod before installation to avoid contamination of the rootzone. If washed sod is not available, then only sod grown in sand or loamy sand soil should be considered. Any sod-soil considered for installation in the project should meet the criteria as outline in Table 4. Big-roll sod is the preferred sod type in order to reduce the seams in the finished installation. Sod delivery and installation procedures should be such to avoid compaction and disruption of the finished grade. (Sod may also be planted mechanically as

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irregular sized pieces in a process called 'plugging,' see 5.6.5.2.) Sod deliveries should be made off the field and the sod moved in on a pallet-by-pallet or roll-by-roll basis as appropriate. Specialized sod handling and installation equipment only should be used during this process to protect the finished grade. For example, with big-roll sod installations, rubber-tracked handling and installation equipment is commercially available.

5.6.5.5 *Recommended Sod Specifications*—If sod is the chosen turf establishment method, the following criteria is a recommended specification for the sod to be used:

(1) Certified Turfgrass Sod—Superior sod grown from Certified (if available), high quality seed (stolons) of known origin, or from plantings of Certified grass seedlings or stolons. It shall be inspected by a sports turf consultant and owners' representative at the sod farm at which it is grown to ensure satisfactory genetic identity and purity, overall high quality, and freedom from noxious weeds, as well as excessive quantities of other crop and weedy plants at time of harvest. All seed or original plant material in mixture should be Certified. Turfgrass sod shall meet the published state or government standards for Certification of the species and cultivar as specified.

(2) Sod may be washed (soil-less) or a special "sand base" material meeting compatibility specifications for sand-based athletic fields as given in Table 4. Sod-soil containing greater than 15 % silt and clay are unacceptable. In most cases, sod thickness should not contain a soil layer greater than 12.5 mm (½ in.). Thick cut (>12.5 mm or >½ in.) sod may be used in cases where insufficient time exists for establishment of sod before play is initiated. In any case, sod-soil should meet appropriate compatibility criteria as given in Table 4.

(3) Strip Size—Sod shall be big roll turf cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 12.5 mm (½ in.) on width and plus or minus 5 % on length. Broken strips and torn or uneven ends will not be accepted.

(4) Time Limitations—Sod shall be harvested, delivered, and transplanted within a 12 h period unless a suitable preservation method is approved by the project designer or project agronomist prior to delivery. Sod not transplanted within this period shall be inspected and approved by the project agronomist and project designer prior to its installation.

(5) Thatch—Sod shall be relatively free of thatch. A maximum of 12.5 mm (½ in.) (uncompressed) thatch will be permitted.

(6) Diseases, Nematodes, and Insects—Sod supplier should be required to supply (and warrant) sod that shall be relatively free (below established acceptable threshold levels) of diseases, parasitic nematodes, and soil-borne insects.

(7) Weeds—Sod shall be free of objectionable grassy and broad leaf weeds.

(8) Sod supplier to identify specific fields for harvest, inspection, and submit a fertility and management program schedule for 6 months prior to harvest.

TABLE 5 Recommended Physical Properties of the Rootzone Mix (Test Method F 1815)

Physical Property	Specified Range
Total porosity	35 to 45 %
Bulk density (kg·m^{-3})	1.5 to 1.7
Air-filled porosity	15 to 25 %
Capillary porosity	15 to 25 %
Saturated hydraulic conductivity (cm/h)	≥25
(Saturated hydraulic conductivity [in./h])	(≥10)

TABLE 6 Recommended Chemical Properties of the Rootzone Mix

Chemical Property	Specified Range
pH (Test Method D 4972)	5.0 to 7.5
Calcium carbonate equivalent, preferred	<5 %
Calcium carbonate equivalent, marginal	5 to 15 %
Organic matter (Test Methods F 1647)	0.5 to 2.5 %
Nutrient content	Adjust for local conditions
Heavy metals or other phytotoxic ions	Adjust for local conditions, do not exceed regulated thresholds

TABLE 7 Recommended Mechanical Properties of the Rootzone Mix

Mechanical Property	Specified Range
Friction angle (degrees) (Test Method D 3080) or, alternatively	38 to 50
Angle of repose (degrees) (Test Method C 1444)	35 to 45
CBR (%) (Test Method D 1883)	12 to 25
Coefficient of Uniformity (CU) of sand component	2.5 to 4.5

6. Recommended Rootzone Performance Criteria

6.1 Several criteria should be considered for proper design of high performance sand-based rootzone construction. These include physical performance criteria, chemical performance criteria, and mechanical performance criteria. The rootzone performance criteria should be considered on the entire rootzone mix rather than on any component separately.

6.2 *Recommended Physical Performance Specifications*—Physical performance criteria (as determined at 40 cm tension for water retention and air-filled porosity) include permeability or saturated hydraulic conductivity, water retention, air-filled porosity, and bulk density. The recommended physical performance criteria are given in Table 5. The physical performance criteria should be given priority over the sand size distribution specifications.

6.3 *Recommended Chemical Performance Specifications*—Chemical performance criteria include pH, calcium carbonate equivalent, organic matter content, nutrient content and the presence of any heavy metals or phytotoxic ions/substances. The recommended chemical performance criteria are given in Table 6.

6.4 *Recommended Mechanical Performance Specifications*—Mechanical performance criteria (for sands) includes shear resistance (specified as friction angle determined by direct, simple, or triaxial shear methodolgies (see Test Method D 3080) when compacted to an initial standard proctor density of 85 % and at 40 cm soil tension (see Test Methods D 698)), confined bearing resistance (confined CBR) at 40 cm soil tension and 85 % standard proctor density (see

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Test Method D 1883) and coefficient of uniformity (CU = D_{60}/D_{10}) of the sand component.

7. Keywords

7.1 athletic field; baseball; clay; cricket; football; natural turf; sand; soccer; softball; soil; sports field; sports turf; turfgrass

APPENDIX

(Nonmandatory Information)

X1. RESOURCE MATERIALS

X1.1 For additional information related to sports fields, consult the following sources of information:

X1.1.1 Sports Turf Managers Association (STMA). STMA, 805 New Hampshire, Suite E, Lawrence, KS 66044, http://www.sportsturfmanager.com.

X1.2 For additional information related to soil modification for athletic field construction, you may desire to consult the following publications:

X1.2.1 Adams, W. A., and Gibbs, R. J., *Natural Turf for Sport and Amenity: Science and Management*, (Oxford Press, 1994).

X1.2.2 Davis, W. B., Paul, J. L., and Bowman, D., "The Sand Putting Green Construction and Management," *University of California Bulletin, Publication # 21448*, University of California, ANR Communication Services, 1990.

X1.2.3 Davis, W. B., Farnham, D. S., and Gowans, K. D., "The Sand Football Field," *California Turfgrass Culture*, Vol. 24(3), 1974, pp. 17–20.

X1.2.4 Goss, R. L., and Cook, T., "Construction and Maintenance of Natural Grass Athletic Fields," *PNW Publication 0240*, Washington State University Cooperative Extension, 1983.

X1.2.5 Harper, J. C., "Athletic Fields—Specification, Outline, Construction, and Maintenance," Penn State University, 1983.

X1.2.6 Keith J. Karnok, ed., *Turfgrass Management Information Directory*, Third Edition, (Hoboken, New Jersey: John Wiley & Sons, Inc.).

X1.2.7 Landschoot, P. J., "Using Composts to Improve Turf Performance," *Cooperative Extension Circular 5M49ps5733*, Penn State University, 1996.

X1.2.8 Peacock, C. H., "Athletic Fields: Design, Construction, and Maintenance," *Bulletin 202*, University of Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, 1999.

X1.2.9 Taylor, D. H., Blake, G. R., and White, D. B., "Construction and Maintenance of Athletic Fields," *University of Minnesota Extension Bulletin 3105*, 1987.

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(1) Soil Science Society of America, *Glossary of Soil Science Terms*, Soil Science Society of America, Madison, WI, 1997.

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(6) Brownell, W. E., *Structural Clay Products*, (Applied mineralogy; v. 9), Springer-Verlag, Wien-New York, 1976.

(7) U.S. Department of Defense, USACE, "Drainage and Erosion Control—Mobilization Construction, Chapter 5, Backfill for Subsurface Drains," *Engineering Manual EM 1110-3-136*, U.S. Government Print Office, Washington, DC, 1984, http://www.usace.army.mil/inet/usace-docs/eng-manuals/em1110-3-136/c-5.pdf.

(8) USGA, Green Section, *USGA Recommendations For A Method Of Putting Green Construction*, USGA, Golf House, Far Hills, NJ, 1993,http://www.usga.org/green/coned/greens/recommendations.html#gravel.

(9) Christiansen, J. E., "Irrigation by Sprinkling," *California Agricultural Experimental Station Bulletin 670*, University of California: Berkeley, CA, 1942.

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Infield Mix Specifications

HUMMEL & CO. INC.

TESTING
#0775-01

Hummel & Co., Inc. • 35 King Street • P.O. Box 606 • Trumansburg, New York 14886 • Phone: (607) 387-5694 • Fax: (607) 387-9499 • Web Site: www.hummelandco.com

BALL DIAMOND MIX TEST REPORT FOR
Read Custom Soils

REPORT TO: Greg Frederick
Read Custom Soils
125 Turnpike Street
Canton, MA 02021

DATE RECEIVED: August 4, 2014
TEST DATE: August 4 - 7, 2014
REPORT DATE: August 7, 2014
REPORT No.: 08071405
CONDITION OF SAMPLE: Normal

PARTICLE SIZE ANALYSIS (ASTM F-1632)

		Gravel (%)		Soil Separate %			Sieve Size/Sand Fraction Sand Particle Diameter % Retained				
Lab ID No.	Sample	No. 5 4 mm	No. 10 2 mm	Sand	Silt	Clay	No. 18 V. coarse 1 mm	No. 35 Coarse 0.5 mm	No. 60 Medium 0.25 mm	No. 140 Fine 0.10 mm	No. 270 V. fine 0.05 mm
34945-3	Native Infield Mix	0.1	0.6	58.7	35.5	5.8	6.1	15.0	16.7	10.4	10.6
Hummel & Co. Guidelines[1]		≤ 3%		65 - 75		≥ 13%		≥ 50% of total sand			

1 In addition, a silt to clay ratio of less than 1, preferably 0.5 to 1.

PARTICLE SHAPE/TEXTURAL CLASS /COLOR

Lab ID No.	Sample	Silt/Clay Ratio	Color	Textural Class
34945-3	Native Infield Mix	6.12	2.5Y 6/4 Light yellowish brown	Sandy loam

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Comments: The Native Infield Mix sample (Lab ID No. 34945-3) was tested as received and was evaluated for baseball/softball infields. While ball diamond mix selection is somewhat subjective, the better products we have tested that have been used with end-user satisfaction are composed of 65 to 75% sand, with a silt to clay ratio of less than 1.

The sample would be classified as a sandy loam, per the U.S Department of Agriculture soil classification system. There was little fine gravel in the sample. The sand content was below the range we recommend.

The clay content was very low and the ratio of silt to clay was high. The infield mix would benefit from the addition of a clay (not calcined) amendment to increase the clay and decrease the silt to clay ratio, and a medium-coarse sand to increase the sand content in desirable sand fractions.

Please let me know if you have any questions on these results or comments. Thank you.

Norman W. Hummel Jr.
President

Seeding Specifications

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Technical Turf News

Touchdown

KENTUCKY BLUEGRASS

The aggressive Kentucky bluegrass that crowds out the competition.

Competitiveness and persistence are what you look for in Kentucky bluegrass—especially on sports turf, golf courses, playgrounds, parks and home lawns.

Description:
Touchdown is a leafy, medium dark green colored, long lived selection of Kentucky bluegrass. Under constant close mowing heights, down to 1/2 inch, *Touchdown* will persist and continue to spread vigorously through a strong underground rhizome system that means tough turf and quick healing from traffic and machine damage.

Disease and Insect Resistance:
Touchdown has always been rated high for its disease resistance, not to mention its ability to compete with Poa annua. In addition to exhibiting good shade tolerance, *Touchdown* is very resistant to Helminthosporium Leaf Spot, Melting Out, Stripe Smut and Summer Patch diseases.

Seeding:
The recommended seeding times for *Touchdown* are early to mid spring, and late summer to early fall. A seeding rate of 3 to 4 pounds per 1000 square feet is recommended. Seeding rates as low as 1.5 to 2 pounds per 1000 square feet can be used where speed of establishment is not important. A soil test is suggested prior to seeding to determine proper fertilizer and lime applications. Generally, incorporating 1 to 1.5 pounds of actual NPK fertilization per 1000 square feet is helpful. Under normal conditions, germination and establishment will occur 10 to 15 days after seeding.

Usage:
Touchdown's aggressiveness and ability to tolerate low mowing heights make it ideal for use in sod production and on golf course tees and fairways, sports fields and parks. *Touchdown* has been widely used in a variety of applications as a perennial turf wherever Kentucky bluegrass is adapted. Best suited to slightly acid soil with pH 6.2 to 8.0

Maintenance:
Generally, *Touchdown* requires 1/2 to 1 pound actual N per 1000 square feet per month of growing season. Apply P and K according to soil tests. Able to tolerate cutting heights as low as 1/2 inch, *Touchdown* does best mowed between 1 to 2.5 inches.

A winner all around—*Touchdown*....go for it!

Technical Product Specifications	
Year of Introduction	1980
Main Uses	Sod, Sports Turf, Golf Courses, Lawns, Parks
Seed Count	1,250,000 seeds/ lb.
Normal Days to Germinate (Fall Plant)	6-9 days
Normal Days to First Mowing (Fall)	38 days
NTEP Quality Ratings (2001 Data)	Very Good (5.6 in 1991-95 data)
Genetic Color	Medium -5.7
Summer Stress Tolerance	Good
Leaf Texture	Medium Fine - 6.3
Turf Density	Medium - 5.1
Shade Tolerance	Medium
Sod Strength	Very High - 86.6 lbs.
Wear Tolerance	Excellent
Close Mowing Tolerance	Very Good-down to 0.75"
Growth Rate	Medium
Mature Plant Height	Medium Tall
Leaf Spot Resistance	Very Good –6.4
pH Range	5.0-7.8
Summer Patch Resistance	Good –6.3
Brown Patch Resistance	Very Good –8.3
Dollar Spot Resistance	Good –6.7
Powdery Mildew Resistance	Very Good

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Technical Data

MERCURY
KENTUCKY BLUEGRASS

Mercury, tested as Pick 232, is a joint release from Rutgers University and Pickseed. It is a hybrid variety developed from crossing C-25 (an "America-type" selection) with P-105 (a very aggressive spreader).

DESCRIPTION:
Mercury is a dark green, medium textured variety with exceptional uniformity. It has medium density and, while it performs very well in the shade, it is also a good summer performer with very good heat and drought tolerance. Mercury has a large seed and above average seedling vigor and establishment. It establishes quickly and produces a tough turf with excellent sod shear strength.

DISEASE AND INSECT RESISTANCE:
Mercury's overall disease resistance is excellent. It has demonstrated excellent resistance to leaf and stem rust, stripe smut and powdery mildew. It has very good resistance to dollar spot, summer patch, brown patch, leaf spot, and melting out.

SEEDING AND ESTABLISHMENT:
Mercury is a larger seeded variety and has above average seedling vigor and establishment. The recommended seeding times are from early to mid spring and from late summer to early fall. Dormant seeding also works well in more northern areas. A seeding rate of 2 – 4 lbs. per 1000 sq. ft. is recommended. A 1 – 2 lb. per 1000 sq. ft. rate can be used under good seeding conditions and where the speed of establishment is not important. Pre plant fertilization is recommended based on a soil test. Generally applying from 1 – 1-1/2 lbs. actual NPK fertilizer per 1000 sq. ft. is recommended. Under normal conditions, germination and seedling emergence will occur within 10 – 15 days after seeding.

USAGE:
Mercury is recommended for use as a high quality component in turfgrass blends and mixtures for sod production, sports fields playgrounds, parks and for home and industrial lawns. It can tolerate a low cutting height, down to 3/4", and has a slower than normal vertical growth rate which is desirable as it requires less mowing.

TECHNICAL PRODUCT SPECIFICATIONS

Year of Introduction	2003
Main Uses	Sod, athletic fields, playgrounds, parks, lawns
Seed Count	1,350,000 seeds / lb.
Normal Days to Germinate	8 – 14
Normal Days to First Mowing	28 – 35
NTEP Quality Ratings (2001 data)	Good
Genetic Color	Medium Dark
Summer Stress Tolerance	Medium
Leaf Texture	Medium
Summer Turf Density	Fair
Shade Tolerance	Medium
Sod Strength	Fair
Wear Tolerance	Fair
Close Mowing Tolerance	Good – to ¾"
Growth Rate	Medium
Mature Plant Height	24"
Leaf Spot Resistance	Good
Summer Patch Resistance	Excellent
Spring Green Up	Above Average
Dollar Spot Resistance	Good
Red Thread Resistance	Good
Rust Resistance	Good

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ARMADA

KENTUCKY BLUEGRASS

Armada (PSG 366) combines the spring and fall growth, high density, and shade tolerance of Compact-America type bluegrasses with quick germination and excellent rhizome formation. It has demonstrated excellent performance under a broad range of conditions from home lawns to golf fairways. It is highly recommended for those areas where stem rust during establishment has become an issue.

DESCRIPTION:
Armada is particularly well adapted to medium and lower maintenance situations. It is a very dense, low-growing variety with a dark green color and medium-fine leaf texture. Armada tolerates mowing heights down to 1/2 inch, and the quick establishment makes Armada ideal for repairs on all bluegrass sites.

USAGE AND DISEASE RESISTANCE:
With its combination of excellent turf quality, disease resistance, combined with top scores for early spring green up, Armada is a great choice for parks, golf courses, and home lawns. Armada can be used alone or blended with other elite Kentucky bluegrasses such as Langara, Crest, Mercury, and Granite.

For overall disease resistance, Armada stands out. Trial data has shown Armada to have excellent resistance to Dollar Spot, Stem Rust, Pink Snow Mold, and Leaf Spot!

MAINTENANCE:
The recommended seeding times for Armada are late summer to early fall (best), and early to mid spring (good). In cold areas, dormant seeding also works well as long as care is taken to delay fall seeding well into the freezing season when seed will not prematurely germinate. A seeding rate of 60 - 80 lbs. per acre is recommended. Under normal conditions, germination and establishment will occur 8 - 10 days after seeding.

TECHNICAL PRODUCT SPECIFICATIONS

Year of Introduction	2010
Main Uses	Sod, Lawns, Golf Courses, Parks
Seed Count	1,200,000 seeds / lb.
Normal Days to Germinate	8-10 days (Fall)
Normal Days to First Mowing	40 days (Fall)
NTEP Quality Ratings (2006 - 2010 Data)	Excellent
Genetic Color	Dark green
Summer Stress Tolerance	Excellent
Leaf Texture	Medium fine
Turf Density	Dense in summer
Sod Strength	Excellent
Wear Tolerance	Very good (Rutgers data)
Close Mowing Tolerance	Excellent—0.5" minimum
Drought Resistance	Very good
Stem Rust Resistance	Very good
Leaf Spot Resistance	Very good
Summer Patch Resistance	Good
Spring Green Up	Excellent
Dollar Spot Resistance	Excellent

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Technical Data

Looking for a ryegrass that's appropriate for every occasion? The Futura family of blended ryegrass from PICKSEED is carefully crafted according to our time-honored standard. Each blend is a distinctive combination of elite varieties, selected for optimal performance.

FUTURA 3000

PERENNIAL RYEGRASS BLEND

DESCRIPTION:
Futura 3000 is PICKSEED's premium blend, a cutting edge combination of the newest and best turf-type perennial ryegrasses available. This blend is frequently updated, and can be customized for geographically-specific application. In any location, for any occasion, Futura 3000 is sure to satisfy the most discriminating tastes. Futura 3000 sets the standard for high-performance ryegrass blends. It features a very dark green color and fine-leafed appearance, and is tolerant of drought, heat and low mowing heights.

A blend comprised of PICKSEED's newest and best perennial ryegrasses, Futura 3000 is flexible. It can contain some of our newest and best perennials on the market including Dasher 3, Fiesta 4, Cutter II, or Seville 3, and is frequently updated to maintain its cutting edge performance. Since not all varieties perform equally in all locations, Futura 3000 can be customized to include the best available varieties for specific geographic applications or conditions.

SEEDING:
Futura 3000 is fast. In warm soils, germination can be expected in 5 – 7 days. Though it establishes quickly, Futura 3000 demonstrates a lower growth habit, so it requires less maintenance. PICKSEED recommends a seeding rate of 5 – 7 lbs. per 1000 sq. ft. in the North. For overseeded Southern golf course greens, 30 – 40 lbs. of Futura 3000 per 1000 sq. ft. gives best results. In normal, warmer soil circumstances, you can expect germination in 5 – 7 days.

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Sod Specifications

3/31/2015 7:56 AM

TUCKAHOE TURF FARMS, INC.
"Instant Lawns"
QUALITY FESCUE & BLUEGRASS SOD
NEW JERSEY

Irrigated Athletic Field

A. Sodding

100% Kentucky Bluegrass, to include these improved varieties (or approved equal):

30% P105 Kentucky Bluegrass
20% Midnight Star Kentucky Bluegrass
30% Bewitched Kentucky Bluegrass
20% Moonlight SLT Kentucky Bluegrass

Contractor shall submit varieties at time of bidding.

Sod shall be machine cut at a uniform soil thickness of one quarter inch (1/4") +- one eighth (1/8"). Measurement for thickness shall exclude top growth and thatch. Sod will be big rolls 62.5' x 4' wide. (No split rolls)

The sod shall be grown on a sandy loam type soil. Sod with a high organic soil will not be allowed. The farm to be approved by owners testing agent.

The owner reserves the right to inspect each roll at the time of delivery. The sod will have a root development that will support its own weight without tearing.

Sod shall be uniform in color, density and thickness.

Sod shall be free of quackgrass, annual bluegrass, bindweed, Canada Thistle, wild onion, Muhlenbergia, bentgrass, Bermuda grass, clover, common broadleaf weeds and plants of varieties than those specified.

The sod producer and installer will have a minimum of five years experience.

Sod shall be delivered and placed within twenty-four hours after being harvested.

The sod contractor shall incorporate fertilizer and lime per test results from owner's agent.

Contractor will lay sod and clean up in a workmen-like manner.

Watering and maintenance shall be done by owner.

Contractor must submit to owner a maintenance schedule.

PO Box 148 – 401 Myrtle Avenue, Hammonton, NJ 08037-0148
Office Number (609) 561-7184 Toll Free (877) 887-3327
Fax Number (609) 561-0296 E-Mail: ttfjames@aol.com
www.ttfarms.com

A. McNitt & SerenSoil Testing

andy@turfsoiltesting.com
tom@turfsoiltesting.com

306 Ravendale Road
PA Furnace, PA 16865
www.TurfSoilTesting.com

Sample:

Tuckahoe Sample

Sample Submitted By: Tuckahoe Turf Farms

Date Received:	6-May-14
Testing Dates:	5/7-5/11
Report Date:	11-May-14

Particle Size Analysis

% Gravel	0.3%
% Sand	95.0%
% Silt	3.5%
% Clay	1.2%

Sand Sieve Size Analysis

	(ASTM F-1632-03)	USGA Specifications	
Gravel (> 2.0 mm)	0.3%	<3%	Maximum 10% combined
Very Coarse Sand (2.0 - 1.0 mm)	2.8%		
Coarse Sand (1.0 - 0.5 mm)	25.5%		Minimum 60% combined
Medium Sand (0.5 - 0.25 mm)	44.5%		
Fine Sand (0.25 - 0.15 mm)	15.3%	<20%	
Very Fine Sand (0.15 - 0.05 mm)	6.9%	<5%	Maximum 10% combined
Silt (0.05 - 0.002 mm)	3.5%	<5%	
Clay (< 0.002 mm)	1.2%	<3%	

Angularity / Sphericity	Acid Reaction	D15	D85	Cu
Sub-Rounded / Medium Sphericity	None	0.17 mm	0.73 mm	2.9

Comments

Mix tested as received.

Drainage Stone Specifications

1/4" RICE STONE

1/4" WASH NATURAL STONE FOR 2" DRAINAGE LATERALS

W.J.GRAVES
CONSTRUCTION CO. INC.

Tel: 978-939-5568
Fax: 978-939-5295

www.wjgraves.com

Sieve Analysis Test Report (T 27)

Date/Time:	2/18/2015	Lab/Location:	W.J. Graves Construction Co., Inc.		
Weather:		Date Rec'd #:		Random Sample:	
Project:		Lab Login #:		Lot #:	
Contract #:		Material ID:	1/4" Round Brown Stone	Sublot #:	
Contractor:		Material #:		Sample Location:	Depot Road
Pay Item #:		Sample #:		Station:	
Source:		Sample Type:		Offset:	
Plant Type:		Sampled By/Cert. #:			

Sieve Analysis of Fine and Coarse Aggregates (T 27)

	Mass per Sieve		% Retained per Sieve		% Passing		Specification %	
Sieve, in. (mm)	Unwashed	Washed	Unwashed	Washed	Unwashed	Washed	Unwashed	Washed
2 1/2 (63)								
2 (50)								
1 1/2 (37.5)								
1 (25)								
3/4 (19)								
1/2 (12.5)								
3/8 (9.5)				0.0		100.0		
1/4 (6.35)				18.2		81.8		
#4 (4.75)				81.3		18.7		
#8 (2.36)				99.0		1.0		
#16 (1.18)				99.2		0.8		
#30 (600 µm)				99.3		0.7		
#50 (300 µm)				99.5		0.5		
#100 (150 µm)				99.7		0.3		
#200 (75 µm)				99.8		0.2		
Pan					Calculate Fineness Modulus?			
Sub Total					Fitness Modulus (FM) =			
Loss on Washing (D - Dw)								
Total								

Comments:

Tested by:	Todd Constantine	Reviewed by:	
Certification #:	252	Certification #:	
Date:	2/18/2015	Date:	

Test Results Within Engineering Limits: YES ☐ NO ☐

3/8 PEASTONE FOR DRAINAGE SYSTEM COLLECTOR DRAIN

W.J. GRAVES
CONSTRUCTION CO. INC.

Tel: 978-939-5568
Fax: 978-939-5295

www.wjgraves.com

Sieve Analysis Test Report (T 27)

Date/Time:	2/17/2015	Lab/Location:	W.J. Graves Construction Co., Inc.		
Weather:		Date Rec'd #:		Random Sample:	
Project:		Lab Login #:		Lot #:	
Contract #:		Material ID:	3/8" Round Brown Stone	Sublot #:	
Contractor:		Material #:		Sample Location:	
Pay Item #:		Sample #:		Station:	
Source:		Sample Type:		Offset:	
Plant Type:		Sampled By/Cert. #:			

Sieve Analysis of Fine and Coarse Aggregates (T 27)

	Mass per Sieve		% Retained per Sieve		% Passing		Specification %	
Sieve, in. (mm)	Unwashed	Washed	Unwashed	Washed	Unwashed	Washed	Unwashed	Washed
2 1/2 (63)								
2 (50)								
1 1/2 (37.5)								
1 (25)								
3/4 (19)								
1/2 (12.5)				0.0		100.0		
3/8 (9.5)				7.3		92.7		
1/4 (6.35)				66.2		33.8		
#4 (4.75)				87.9		12.1		
#8 (2.36)				99.7		0.3		
#16 (1.18)				99.8		0.2		
#30 (600 µm)				99.9		0.1		
#50 (300 µm)								
#100 (150 µm)								
#200 (75 µm)								
Pan					Calculate Fineness Modulus?			
Sub Total					Fitness Modulus (FM) =			
Loss on Washing (D - Dw)								
Total								

Comments:

Tested by:	Todd Constantine	Reviewed by:	
Certification #:	252	Certification #:	
Date:	2/17/2015	Date:	

Test Results Within Engineering Limits: YES ☐ NO ☐

Recommended Equipment Specifications

Equipment Specifications

Excavation, Earth Moving, and Grading

Utilize Model 550 J Crawler Dozer as manufactured by John Deere equipment or equal which meets the following specifications:

- Laser T guided capability
- Tier 3 / Stage 3A emissions certified engine
- Net power – 85 hp at 2200 rpm
- Maximum speed (forward and reverse) 5mph
- Track gauge – 5 ft.
- Length of track on ground – 7 ft. 2in.
- Ground contact area – 4128 sq. in.
- Maximum ground pressure – 5.8 psi
- Number of track rollers – 6
- Track pitch – 6.29 in.
- Track shoes, each side – 40
- Standard shoe type – single grouser
- Blade width – 9 ft. 7 in.
- Blade height – 3 ft. 2 in.
- SAE blade capacity – 2/57 cu. yd.
- Blade lift height – 2ft. 7 in.
- Digging depth – 20.6 in.
- Blade tilt – 1 ft. 3 in.
- Ground clearance – 14 in.
- SAE operating weight – 18,252 lbs.

Utilize Model Z Axis 50 U Series Mini Excavator as manufactured by Hitachi or equal which meets the following specifications:

- Net power – 40 hp at 2,500 rpm
- Weight – 10,758 lbs.
- Speed – 1.7 to 2.8 mph
- Track – rubberized 15 in.
- Maximum ground pressure – 4.49 psi
- Ground clearance – 13 in.
- Front grading blade width – 78 in.
- Grade ability – 30°
- Maximum digging reach – 236 in.
- Maximum digging depth – 141 in.

- Maximum cutting height – 222 in.
- Maximum vertical wall – 111 in.

Stripping of Existing Grass Surface

Utilize Model FTM 2000 Koro Field Top Maker as Manufactured by Pols International, Stationsweg 36, 3214 VK Zuidland, Netherlands or equal which meets the following specifications:

- Working width – 78 in.
- Working depth – 1.75 in.
- Weight – 2448 lbs.
- Horsepower requirements – 70 hp
- Number of cutting blades – 64
- Side conveyor extension

Utilize Model 6425 Turf Tractor as manufactured by John Deere Equipment or equal which meets the following specifications:

- Engine power – 125 hp
- PTO power – 114 hp
- Wheelbase – 94.5 in.
- Weight – 10,064 lbs.
- Rear lift – 5,100 lbs.
- Front tire – 10.00 – 16 low ground pressure high floatation turf tire
- Rear tire – 16.9 - 30 low ground pressure high floatation turf tire

Hauling of Stripped Material off Field

Utilize Dirtcub Hydraulic Dump-box as manufactured by TYCROP Manufacturing or equal which meets the following specifications:

- Bed size - 60 13/16" W x 70 1/8"L
- Unit Size - 68 1/8"W x 45 9/16"H
- Weight - 956 lbs.
- Payload: 3000 lbs.
- Suspension – Low ground pressure (maximum 5 psi) 4 wheel walking beam evenly distributing

Utilize Model 4720 Turf Tractor as Manufactured by John Deere Equipment or equal which meets the following requirements:

- Engine power – 58 hp
- PTO power – 56 hp
- Wheelbase – 71.5 in.
- Weight – 3,860 lbs.
- Rearlift – 2,500 lbs.

- Front tire – 8.00 – 16 low ground pressure high floatation turf tire
- Rear tire – 13.6 – 28 low ground pressure high floatation turf tire

Loading, Backfilling, Power Raking Specifications

Utilize Model 287 Compact Track and Multi Terrain Loader as manufactured by Caterpillar Inc, or equal which meets the following specifications:

- Net Power – 82 HP
- Operating Weight – 10,275 lb.
- Maximum speed (forward and reverse) – 7mph
- Length of Track on Ground – 73 in.
- Ground contact area – 2,610 sq. in.
- Maximum ground pressure – 3.8 psi
- Ground clearance – 11 in.
- Vehicle width – 77 in.
- Clearance at maximum lift/dump – 94 in.
- Quick connect accessory and implement capability

Utilize Model MX7H Hydraulic Power Angle Mounted Grading and Blending Implement as manufactured by Harley Rake or equal and meets the following specifications:

- Front attachment plate for track and multi terrain loader
- Working width to cover multi terrain loader trucks
- Aggressor pointed carbide teeth
- Dual independently adjustable gauge wheels
- Weight – 1050 lb.
- Length – 64 in.
- Width (overall) – 93 in.
- Raking width – 84 in.
- Raking width (full angle) – 79 in.
- Angle roll - 20°
- Removable /reversible end plates

Utilize Model TD – 460 low ground pressure large area top dresser as manufactured by Tycrop Manufacturing or equal which meets the following specifications:

- Weight – 3,400 lbs.
- Length – 167 in.
- Height – 63 in.
- Width – 89 in.

- Hopper load capacity – 75 cu. ft.
- Capability to spread wet or dry materials including soil mixes, sand, stone, gravel, inorganic material, composted products and wood chips.
- Capability to perform as a multifunctional trailer for material handling and relocation tasks with an unloading time of 30 seconds.
- Low ground pressure four wheel walking beam suspension
- Unlockable metering gate to float freely during bulk unloading operations
- Removable metering gate for hauling construction and landscape materials
- Independent control valves for adjusting the speed of floor conveyor belt and the finishing brush
- 72" wide spread and distribution of material

Utilize Model BV150 Ground preparation machine as manufactured by BLEC USA or equal which meets the following specifications:

- Working width – 60 in.
- Working depth – 9in.
- Gear box – single speed 540 RPM
- No. of blades – 36
- Overload safety- friction multiplate clutch
- Maximum working output / hr. 4300 sq. yd.
- Maximum 1.5 mph working speed – 2.0 mph
- 3 point hitch – cat 2
- Weight – 2,300 lbs.
- Length – 71 in.
- Height – 44in
- Width – 82 in.

Utilize Model 5425 Turf Tractor as manufactured by John Deere Equipment or equal which meets the following specifications:

- Engine power – 81 hp
- PTO power – 65 hp
- Wheelbase – 85.7 in.
- Weight – 7,385 lbs.
- Rear lift – 3,374 lbs.
- Front tire – 7.50 – 16 low ground pressure high floatation turf tire
- Rear tire – 16.9 – 30 low ground pressure high floatation turf tire

Finish Grading

Utilize Model 106 P Compact Motorized Cross Slope Dual Laser Grader as manufactured by Laser-Grader Manufacturing or equal which meets the following specifications:

- Weight – 3,200 lbs.
- Length – 11 ft. 6 in.
- Height – 7 ft. 2 in.
- Width (excluding blades) – 4 ft
- Front pusher blade width – 5ft
- Mold board width – 6 ft.
- Mold board height – 12 in.
- Variable speed: 0 – 10 mph
- Outside turning radius – 9 ft.
- Inside turning radius – 5 ft.
- Mold board functions –
    - Left and right manual raise and lower
    - Side shift and blade rotation
- Grading tolerance – +/- 1/8 in. accuracy equipped with Trimble GCS 600 Grade Control System with two LR410 laser receivers monitored by dual LED grade displays as programmed through a CB420 control box providing the ability to calculate angle, slope and cross slope
- Trimble control package plumbed into hydraulics for "automatic" laser control
- 6 wheel drive via hydraulic wheel motors
- Power steering
- ROPS certified roll bar

Seed/Sodbed Preparation

Utilize Model 13-550 Super Rake as manufactured by Smithco or equal which meets the following specifications:

- Power – 16 hp
- Weight – 990 lbs.
- Configuration – 3 – wheel tricycle rear engine placement
- Drive - direct drive hydrostatic
- Speed – 0 – 9 mph
- Tires – 10.50 x 12 turf tires
- Length – 85 in.
- Width – 74 in.
- Height – 44 in.
- Wheelbase – 47 in.
- Equipped with center mounted sand cultivator
- Equipped with rear mounted sand rake assembly
- Equipped with rear mounted 6 ft. wide steel mesh drag mat

Seeding

Utilize Model 1575 Overseeder as manufactured by Redexim North America or equal which meets the following specifications:

- Weight – 2,293 lbs.
- Working width – 62.2 in.
- Working depth: 0.19 in. – 0.78 in.
- Seeding speed – 7.5 mph
- Seeding row spacing – 2.9 in.
- Disk quantity – 21
- Seed tray capacity – 7.9 cu. ft.
- Seeding density per 1,000 sq. ft.: 0.44 lbs. – 8.82 lbs.
- Water fillable back roller with scraper
- Individual seed planting
- Twin discs to contour with ground undulations
- Integrated seed spreading tray

Sod Installation

Utilize Model 4826 D All Terrain Rubber Track Turf Installer as manufactured by KWMI Turf Equipment or equal which meets the following specifications:

- Weight – 2,300 lbs.
- Length – 92 in.
- Height – 56 in.
- Width – 80 in.
- Maximum roll capacity – 48 in.
- Load capacity – 2,500 lbs.
- Ground pressure weight – 3 psi
- Rubber track width – 10 in.

Compaction

Utilize Model CC900G Double Drum Vibratory Roller as manufactured by Dynapac Compaction Equipment or equal which meets the following specifications:

- Maximum operating mass – 3,322 lbs.
- Front module mass – 1,309 lbs.
- Rear module mass 1,628 lbs.
- Speed range: 0 – 5 mph
- Roller width – 36 in.

2" Drainage Lateral Installation

Utilize Model AFT Wizz Wheel 75 as manufactured by Specialized Turf Equipment Company or equal which meets the following specifications:

- Trenching up to 2,000 meters per hour.
- Digging widths from 50 to 155mm (2"-6").
- Pocket held reversible soil blades.
- Range of carbide teeth and bullets.
- Continuously variable depth control, which can be controlled by laser.
- Fold back conveyor for easy transport.
- Range of pipe/cable chutes, reel carriers and attached gravel hoppers for one pass operation.

CH15

SPECIALIZED TURF EQUIPMENT COMPANY

Toll Free: 1-888-325-2532 | Office: 864-225-3666 | Fax: 864-225-3640 | Email: sales@stecequipment.com

AFT Wizz Wheel 75

- **Trenching up to 2000 meters per hour.**
- **Digging widths from 50 to 155mm (2" – 6").**
- **Pocket held reversible soil blades**
- **Range of carbide teeth and bullets**
- **Continuously variable depth control, which can be controlled by laser**
- **Fold back conveyor for easy transport**
- **Range of pipe/cable chutes, reel carriers and attached gravel hoppers for one pass operation**

The perfect slit trencher!

A powerful and rugged wheel trencher for tractors from 90 to 140hp (60-105kW), the **Wizz Wheel 75** is designed for the installation of intensive sports turf drainage systems and also widely used for installation of fibre optic cables all over the world. The **Wizz Wheel 75** is the undisputed leader in its class. it is indispensable for contractors who need to get the job done, whatever the conditions.

SPECIALIZED TURF EQUIPMENT COMPANY

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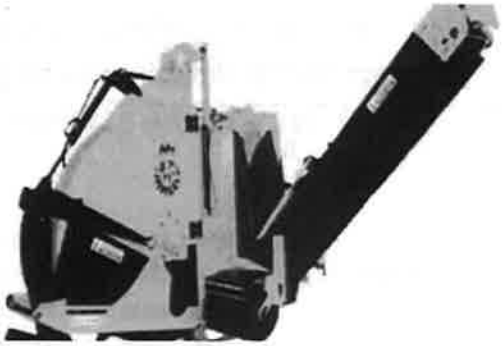
AFT Wizz Wheel 75 Specifications	
Prime Mover	Tractor
Digging Method	Wheel
Minimum Digging Width	2"
Maximum Digging Width	6"
Maximum Digging Depth	30"
HP Required	90-140
Hydraulic System Min. GPM/PSI	11/2175
Conveyer Clean-Up Option	Yes



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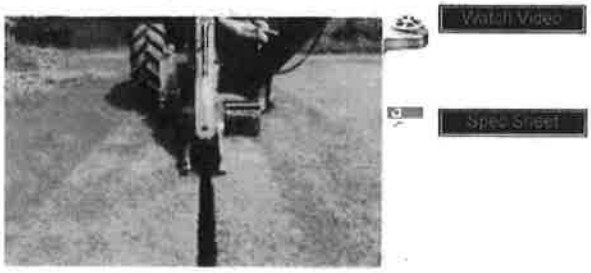
Wizz Wheel 75



- **Trenching up to 2000 meters per hour.**
- **Digging widths from 50 to 155mm (2" – 6").**
- **Pocket held reversible soil blades**
- **Range of carbide teeth and bullets**
- **Continuously variable depth control, which can be controlled by laser**
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APPENDIX E

PLAY MANUFACTURER SPECIFICATIONS AND DETAILS

Material Specifications
Quote: meo15526 PlayShaper® (2-5 years)
8/5/2016

General Specifications:

Material: All materials shall be structurally sound and suitable for safe play. Durability shall be ensured on all steel parts by the use of time-tested coatings such as zinc plating, galvanizing, ProShield finish, TenderTuff coating, etc. Colors shall be specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F879 unless otherwise indicated (see specific product installation/specifications). All primary fasteners shall include a locking patch-type material that will meet the minimum torque requirements of IFI-125. Manufacturer to provide special tools for pinned tamperproof fasteners.

TenderTuff Coating: Metal components to be TenderTuff-coated shall be thoroughly cleaned in a hot phosphatizing pressure washer, then primed with a water-based thermosetting solution. Primed parts shall be preheated prior to dipping in UV-stabilized, liquid polyvinyl chloride (PVC), then salt cured at approximately 400 degrees fahrenheit (200 degrees celsius). The finished coating shall be approximately .080" (2,03 mm) thick at an 85 durometer with a minimum tensile strength of 1700 PSI (11721,09 Kilopascals)and a minimum tear strength of 250 pounds/inch (0.028 kilonewton meters). Five standard colors are available all with a matte finish. (Brown only for HealthBeat). Not applicable for Evos.

ProShield Finish: All metal components with ProShield finish shall be thoroughly cleaned and phosphatized through a five-stage power washer. Parts are then thoroughly dried, preheated and processed through a set of automatic powder spray guns where a minimum .002" (0,05 mm) of epoxy primer is applied. A minimum .004” (0,10 mm) of architectural-grade Super-Durable polyester TGIC powder is applied. The average ProShield film thickness is .006" (1,52 mm).

ProShield is formulated and tested per the following ASTM standards. Each color must meet or exceed the ratings listed below:

Hardness (D3363) rating 2H
Flexibility (D522) pass 1/8" (3,17 mm) mandrel
Impact (D2794) rating minimum 80 inch-pounds (9.038 newton meters)
Salt Fog Resistance (B117 and D1654) 4,000 hours and rating 6
or greater
UV Exposure (G154, 340 bulb) 3,000 hours, rating delta E of 2,
and 90 percent gloss retention
Adhesion (D3359, Method B) rating 5B

The Paint Line shall employ a "checkered" adhesion test daily.

26 standard colors are available.

Decks: All Tenderdecks shall be of modular design and have 5/16" (7,92 mm) diameter holes on the standing surface. There shall be a minimum of (4) slots in each face to accommodate face mounting of components. Tenderdecks shall be manufactured from a single piece of low carbon 12 GA (.105") (2,66 mm) sheet steel conforming to ASTM specification A-1011. The sheet shall be perforated with a return flange on the perimeter to provide the reinforcement to ensure structural integrity. There shall be no unsupported

area larger than 3.5 square feet (0.3251 square meters). The unit shall then be TenderTuff-coated brown or gray only. Tenderdecks shall be designed so that all sides are flush with the outside edge of the supporting posts. Not applicable for Evos, Weevos or HealthBeat.

Rotationally Molded Polyethylene Parts: These parts shall be molded using prime compounded linear low-density polyethylene with a tensile strength of 2500 psi (17236,9 kilopascals) per ASTM D638 and with color and UV-stabilizing additives. Wall thickness varies by product from .187" (3/16") (4,75 mm) to .312" (5/16") (7,92 mm). Five standard colors are available (Black only for HealthBeat).

Permalene Parts: These parts shall be manufactured from 3/4" (19,05 mm) high-density polyethylene that has been specially formulated for optimum UV stability and color retention. Products shall meet or exceed density of .960 G/cc per ASTM D1505, tensile strength of 2400 PSI (16547,42 kilopascals) per ASTM D638. Five standard solid colors are available. Some Permalene parts are available in a two-color product with (2) .100" (2,54 mm) thick exterior layers over a .550" (13,97 mm) interior core of a contrasting color. Eight standard two-color options are available. Not applicable for Evos or HealthBeat.

Recycled Permalene® Parts: These parts shall be manufactured from 3/4" (19,05 mm) high-density polyethylene that has been specially formulated for optimum UV stability and color retention. Products shall meet or exceed density of .960 G/cc per ASTM D1505, tensile strength of 2400 PSI (16547,42 Kilopascals) per ASTM D638. Available in a three-layer product with (2) .100" (2,54 mm) thick colored exterior layers over a .550" (13,97 mm) thick 100% recycled Black interior core. Eleven standard color options are available. Not applicable for Evos or HealthBeat.

Footings: Unless otherwise specified, the bury on all footings shall be 34" (864 mm) below Finished Grade (FG) on all in-ground play events/posts. Other types of anchoring are available upon request.

Hardware Packages: All shipments shall include individual component-specific hardware packages. Each hardware package shall be labeled with the part number, description, a component diagram showing the appropriate component, package weight, a bar code linking the hardware package to the job number, assembler's name, date and time the package was assembled, work center number, and work order number.

Installation Documentation: All shipments shall include a notebook or packet of order-specific, step-by-step instructions for assembly of each component, including equipment assembly diagrams, estimated hours for assembly, footing dimensions, concrete quantity for direct bury components, fall height information, area required information and detailed material specifications.

Packing List: All shipments shall include a packing list for each skid/container, specifying the part numbers and quantities on each skid or within each container.

Packaging: PlayBooster posts shall be individually packaged in sturdy, water-resistant, mar-resistant cardboard boxes. Other components shall be individually wrapped or bulk wrapped to provide protection during shipment. Small parts and hardware packages will be placed in crates for shipment. The components and crates are then shrink-wrapped to skids (pallets) to ensure secure shipping.

Maintenance Kit: An order-specific maintenance kit shall be provided for each structure order. The kit will include a notebook or packet with a second set of installation documents and order-specific maintenance documentation with recommendations on how often to inspect, what to look for and what to do to keep the equipment in like-new condition. The kit also includes touch-up primer, appropriate color touch-up

paint, sandpaper, appropriate color touch-up PVC, graffiti remover and additional installation tools for the tamperproof fasteners.

(PS) General Specifications:

Posts: 2 3/8" (60,33 mm) square aluminum posts shall have a minimum wall thickness of .125" (3,17 mm) and be extruded of 6005-T5 aluminum alloy and have rounded corners and ribbed faces for maximum safety. A cast aluminum top cap shall be installed at the factory with stainless steel knurled spacers and aluminum drive rivets. Flanges for panels and deck supports shall be extruded of 6005-T5 aluminum alloy and slide into slots extruded in posts. Flanges and deck supports shall be attached in the factory with stainless steel knurled spacers and aluminum drive rivets. All direct bury posts shall have a "finished grade marker" positioned on the post identifying the 34" (864 mm) bury line and the top of the required surfacing. A molded low-density polyethylene cap, with drain holes, shall be pressed onto the bottom end of the post to increase the footing area. Posts shall have a post number sticker for installation purposes. All surface mount posts shall be continuously welded to a 1/4" x 6" (6,35 mm x 152 mm) square 6061-T6 aluminum surface mount plate and allow for 2" (51 mm) of protective surfacing. Posts shall be ProShield finished to a specified color.

Aluminum Post Mechanical Properties:
Yield Strength (min): 35,000 PSI (241316,57 Kilopascals)
Tensile Strength (min): 38,000 PSI (262000,85 Kilopascals)
% Elongation in 2 inches (51 mm): 10
Modulus of Elasticity: 10 x 1,000,000 PSI
(6894759,09 Kilopascals)

Arch Posts: Arch posts shall have the same shape as the posts and be extruded from 6063-T4 aluminum alloy. Roof support flanges shall be of the same shape and material as the panel flanges. Arch shall be formed in a 180 degree arc on a 21" (533 mm) center line radius. Arches shall be secured to standard length posts with solid aluminum sleeves that are tapped to receive (16) 3/8" x 5/8" (9,53 mm x 15,88 mm) pinned button head cap screws per arch. Arch posts shall be ProShield finished to a specified color.

Material Specifications:

111348A

Arch Bridge

Attachment Bracket: Fabricated from 1/8" x 1 1/4" x 2" (3,17 mm x 31,75 mm x 51 mm) 6061-T6 aluminum angle. Finish: ProShield, color specified.

Panels: Permalene panel measures 41" (1041 mm) wide x 34 15/16" (887,40 mm) high, color specified.

Bridge Deck: Fabricated from 12 GA (.105") (2,66 mm) sheet steel conforming to ASTM A1011. Standing surface is perforated with 5/16" (7,92 mm) diameter holes. Finish: TenderTuff, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

132828A

Ramp Deck To Deck Perm Barrier

Barrier Panel: One-color Permalene panel measures 29 3/16" (741,35 mm) wide x 33 3/4" (857,25 mm) high, color specified.

Ramp Handrail: Weldment comprised of 1.660" (42,16 mm) O.D. RS-20 (.085" - .095") (2,16 mm-2,41 mm) galvanized steel tubing, 1.315" (33,40 mm) O.D. RS-20 (.080" - .090") (2,03 mm-2,28 mm) galvanized steel tubing, 1/8" x 1 1/2" x 18" (3,17 mm x 38,1 mm x 457 mm) flat steel and 3/16" x 2" x 3" (4,75 mm x 51 mm x 76 mm) steel tabs. Finish: ProShield, color specified.

Ramp Plank: Fabricated from 11 GA (.120") (3,04 mm) sheet steel conforming to ASTM A1011. Standing surface is perforated with 5/16" (7,92 mm) diameter holes. Finish: TenderTuff, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

135346C

Pod Climber 32"Dk DB

Panel: Permalene, color specified.

Disc: Rotationally molded from U.V. stabilized linear low density polyethylene, disc measures 14" (356 mm) in diameter x 7" (178 mm) high, color specified.

Handloop: Weldment comprised of 1.125" (28,58 mm) O.D. x 11 GA (.120") (3,04 mm) steel tubing with 203 or 303 stainless steel inserts, with 3/8" (9,53 mm) internal thread. Finish: TenderTuff, color specified.

Handrail: Weldment comprised of 1.125" (28,58 mm) O.D. x 11 GA (.120") (3,04 mm) steel tubing with 203 or 303 stainless steel welded inserts with 3/8" (9,53 mm) internal threads. Finish: TenderTuff, color specified.

Support: Weldment comprised of 1.900" (48,26 mm) O.D. RS-20 (.090" - .100") (2,28 mm-2,54 mm), 1.315" (33,40 mm) O.D. RS-20 (.080" - .090") (2,03 mm-2,28 mm) and 3/16" x 5" (4,75 mm x 127 mm) diameter plate. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

137966A

Critter Canyon Climber 32"Dk DB

Insect Panel: Two color panel measures 39 1/2" (1003,3 mm)wide x 31 3/16" (792,15 mm) high, color specified.

Critter Canyon: Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Support: Weldment comprised of 1.660" (42,16 mm) O.D. RS20 (.085"-.095") (2,16 mm-2,41 mm) galvanized steel tubing and fabricated 11 GA. (.120") (3,04 mm) 304 stainless steel plate. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

143200A

Conical Climber DB

Belt: PVC belting, 5/16" (7,92 mm) thick, 300 PIW tension rating.

Center Loop: Weldment comprised of 1.315" (33,40 mm) O.D. RS-20 (.080" - .090") (2,03 mm-2,28 mm) galvanized steel tubing, 1/4" x 1 1/4" (6,35 mm x 31,75 mm) HR flat steel and 1/4" x 2 3/4" (6,35 mm x 69,85 mm) HR flat steel. Finish: ProShield, color specified.

Footer: Fabricated from 1.125" (28,58 mm) O.D. x 11 GA (.120") (3,04 mm) galvanized steel tubing. Finish: ProShield, color specified.

Hand Grip: Made from Polyester Resin. Hand Grips measure 5 3/4" (146,05 mm) long x 2 1/2" (63,5 mm) wide x 1 3/4" (44,45 mm) high.

Mounting Plate: Fabricated from 1/8" (3,17 mm) HR flat steel. Finish: ProShield, green in color.

Rails: Weldment comprised of 1.315" (33,40 mm) O.D. RS-20 (.080" - .090") (2,03 mm-2,28 mm) galvanized steel tubing, and 1/4" x 1 1/4" (6,35 mm x 31,75 mm) HR flat steel. Finish: ProShield, color specified.

Handhold Panel: Recycled Permalene, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

153077A

Mini Summit Climber 48"Dk DB

Support: Weldment comprised of 2.375" (60,33 mm) O.D. RS-20 (.095" - .105") (2,41 mm-2,66 mm) galvanized steel tubing and 1/4" x 3" (6,35 mm x 76 mm) mounting plate. Finish: ProShield, color specified.

Summit Climber: Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Handhold Panel: Permalene, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

111237A

Square Tenderdeck

Square Deck: Flange formed from 12 GA (.105") (2,66 mm) sheet steel conforming to ASTM A1011. Standing surface is perforated with 5/16" (7,92 mm) diameter holes. Deck face has (4) slotted holes for face mounting components. The finished size measures 2 5/8" x 44 3/8" x 44 3/8" (66,68 mm x 1127,13 mm x 1127,13 mm). Finish: TenderTuff, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

153020A

Curved Transfer Module 32"Dk Right DB

Railings: Weldment comprised of formed 1 1/8" (28,58 mm) O.D. x 11 GA (.120") (3,04 mm) steel tubing, 3/16" (4,75 mm) thick HRPO flat steel, 3/16" (4,75 mm) thick HRPO steel plate and 3/4" (19,05 mm) O.D. x 11 GA. (.120") (3,04 mm) stainless steel tubing. Finish: TenderTuff, color specified.

Step Support: Weldment comprised of 1.660" (42,16 mm) O.D. RS-20 (.080" - .095") (2,03 mm-2,41 mm) galvanized steel tubing and 1 3/4" x 1 3/4" x 1/8" (44,45 mm x 44,45 mm x 3,17 mm) HR angle. Finish: ProShield, color specified.

Step Sections/Top Step Section: Formed from 12 GA (.105") (2,66 mm) HRPO sheet steel conforming to ASTM A1011. Standing surface is 24 3/8" (619,13 mm) wide x 14" (355,6 mm) deep and is perforated with 5/16" (7,92 mm) diameter holes. Finish: TenderTuff, color specified.

Deck Support: Weldment comprised of 3 1/2" (88,9 mm) O.D. RS-20 (.125") (3,17 mm) galvanized steel tubing and 3/8" (9,53 mm) O.D. x 5" (127 mm) long CRS rod. Finish: ProShield, color specified.

Deck: Flange formed from 12 GA (.105") (2,66 mm) HRPO sheet steel conforming to ASTM A1011. Standing surface is perforated with 5/16" (7,92 mm) diameter holes and measures 29" (737 mm) per (2) sides. Finish: TenderTuff, color specified.

Panels: Permalene, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

111292A

Table Panel DB

Permalene Panel: One-color panel measures 39 1/2" (1003,3 mm) wide x 30" (762 mm) high, color specified.

Frame: Weldment comprised of 3/16" x 2" x 1 1/4" (4,75 mm x 51 mm x 31,75 mm) HRS angle and 3/16" x 2" (4,75 mm x 51 mm) flat steel bar. Finish: ProShield, color matched to posts.

Table Top Bracket: Fabricated from 1/4" x 3 1/2" x 28 9/16" (6,35 mm x 88,9 mm x 725,47 mm) HRPO flat steel. Finish: ProShield, color matched to posts.

Table Panel: One-color Permalene panel measures 19 1/2" (495,3 mm) wide x 34 3/4" (882,65 mm) long, color specified.

Permalene Panel: One-color panel measures 39 1/2" (1003,3 mm) wide x 30" (762 mm) high, color specified.

Support Leg: Weldment comprised of 2.375" (60,33 mm) O.D. RS-20 (.095" - .105") (2,41 mm-2,66 mm) galvanized steel tubing and 1/4" x 2 1/2" x 9" (6,35 mm x 63,5 mm x (229 mm) flat plate. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

113211A

Chimes Panel Above Deck

Permalene Panel: One-color panel measures 39 1/2" (1003,3 mm) wide x 30" (762 mm) high, color specified.

Chimes: Fabricated from 6063-T832 aluminum. Finish: Anodized per Mil - A - 8625 type 2, class 1.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

116120A

2 Benches w/1 End Panel Each

Bench: Flange formed from 12 GA (.105") (2,66 mm) sheet steel conforming to ASTM A1011. Seating surface is perforated with 1/4" (6,35 mm) diameter holes. Finish: TenderTuff, color specified.

Permalene Panel: One-color, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

117946A

Wire Barrier

Barrier: Weldment comprised of 1 1/8" (28,58 mm) O.D. steel horizontal rails with 203 or 303 stainless steel welded inserts with 5/8" (15,88 mm) internal threads, 1/4" x 1 1/4" (6,35 mm x 31,75 mm) HRPO flat steel and 1/4" (6,35 mm) diameter wire. Barrier measures 39 1/4" (996,95 mm) wide x 30 13/16" (782,62 mm) high. Finish: TenderTuff, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

139260B

Balcony Deck w/Wheel

Wheel: 12" (305 mm) diameter cast A319.1 aluminum alloy. Shaft-303 stainless steel. Finish: TenderTuff, color specified.

Wheel Bracket: Weldment comprised of formed 3/16" (4,75 mm) plate and 5/8" (15,88 mm) O.D. stainelss steel shaft. Finish: ProShield, color specified.

Wheel Clamp: Formed from 3/16" x 2" (4,75 mm x 52 mm) HRPO zinc-plated. Finish: ProShield, color specified.

Barrier: Weldment comprised of 5/8" (15,87 mm) solid steel vertical rails, 1 1/8" (28,57 mm) O.D. steel horizontal rails with 203 or 303 stainless steel welded inserts with 5/8" (15,87 mm) internal threads. Finish: TenderTuff, color specified.

Deck: Fabricated from 12 GA (.105") (2,66 mm) sheet steel conforming to ASTM A1011. Standing surface is perforated with 5/16" (7,93 mm) diameter holes perforated. The finished size measures 2 5/8" x 34" (66,67 mm x 863 mm) (straight edge) x 17" (431 mm) radius (curved edge). Finish: TenderTuff, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

144984A

Storefront Panel

Store Panel: One-color Permalene, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

164093A

Bongo Panel Above Deck

Permalene Panel: Two color panel measures 39 1/2" (1003,3 mm) wide x 30" (762 mm) high, color specified.

Screen Plate: Fabricated from 12 GA. (.105") (2,66 mm) HRPO flat steel. Finish: Black in color.

Bongo: Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

111397H

69"Post DB

Post: See PlayShaper (PS) General Specifications.

111397D

98"Post DB

Post: See PlayShaper (PS) General Specifications.

111397C

106"Post DB

Post: See PlayShaper (PS) General Specifications.

111397B

114"Post DB

Post: See PlayShaper (PS) General Specifications.

111397A

128"Post DB

Post: See PlayShaper (PS) General Specifications.

168099A

Cozy Dome DB

Ring Plate: Fabricated from 1/4" (6,35 mm) HRPO steel plate. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Cozy Dome Panel: Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Direct Bury Plate: Weldment comprised of 2.375" (60,33 mm) O.D. RS20 (.095"-.105") (2,41 mm-2,66 mm) wall galvanized steel tubing and 1/4" (6,35 mm) HRPO steel plate. Finish: ProShield, color specified.

Mount Plate: Fabricated from 1/4" (6,35 mm) HRPO steel plate. Finish: ProShield, color specified.

132117C

SlideWinder2 48"Dk DB 1 Straight 1 Left

Rail Spacer: Fabricated from 1.312" (33,32 mm) O.D. x 16 Ga. (.065") (1,65 mm) steel tubing. Finish: ProShield, color specified.

Rail: 1 1/8" (28,58 mm) O.D. 6061-T6 aluminum extrusion with 5/16" (7,92 mm) walls. Finish: ProShield, color specified.

Slide Sections: Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Exit Footer: Weldment comprised of 2.375" (60,33 mm) O.D. RS-20 (.095" - .105") (2,41 mm-2,66 mm) galvanized steel tubing and 1/4" x 3" x 7 1/2" (6,35 mm x 76 mm x 191 mm) HRPO steel mounting plate. Finish: ProShield, color specified.

Mid-Support: Weldment comprised of 1.900" (48,26 mm) O.D. RS20 (.090" - .100") (2,28 mm-2,54 mm) galvanized steel tubing and 7 GA. (.179") (4,54 mm) HRPO steel strap. Finish: ProShield, color specified.

Support Base (SM): Weldment comprised of 1.660" (42,16 mm) O.D. RS-20 (.085" - .095") (2,16 mm-2,41 mm) galvanized steel tubing and 1/4" x 3" x 8" (6,35 mm x 76 mm x 203 mm) mounting plate. Finish: ProShield, color specified.

Offset Bolt Bracket:Cast aluminum. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

132155B

Double Slide 40"Dk DB

Exit Support: Weldment comprised of 2.375" (60,33 mm) O.D. RS-20 (.095" - .105") (2,41 mm x 2,66 mm) galvanized steel tubing and 1/4" x 3" (6,35 mm x 76 mm) mounting plate. Finish: ProShield, color specified.

Slide: Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Rail Spacer: Fabricated from 1.312" (33,32 mm) O.D. x 16 GA (.065") (1,65 mm) steel tubing. Finish: ProShield, color specified.

Spacer: One-color Permalene, color specified.

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Rail: Extruded from 1.125" ((28,58 mm) O.D. x .312" (7,92 mm) wall. 6005-T5 aluminum. Finish: ProShield, color specified.

Slide Hood: Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Offset Bolt Bracket:Cast aluminum. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

128953A

28" Crawl Tunnel 28" w/o View Above Deck

Clear Cover: Drape formed .177" x 23" x 30 7/8" (4,50 mm x 584 mm x 784,23 mm) clear polycarbonate.

Tunnel Section: Rotationally molded from U.V. stabilized linear low-density polyethylene, color specified.

Permalene Panel: One-color panel measures 39 1/2" (1003,3 mm) wide x 30" (762 mm) high, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

139268A

Offset Crawl Tunnel 8"Offset

Tunnel Panel: One-color Permalene panel measures 39 1/2" (1003,3 mm) wide x 30" (762 mm) high, color specified.

Tunnel Section: Rotationally molded from U.V. stabilized linear low-density polyethylene, color specified.

Attachment Blocks: U.V. stabilized high-density polyethylene, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Warranty: You have our word.

More than just a contract, our warranty is our personal commitment that you'll be satisfied with your purchase now and well into the future. As an employee-owned company we take great pride in the quality of everything we make. And we're so confident that you'll be delighted with your purchase that we back our products with the most comprehensive long-term warranties in the industry. It's just one more way that we show how much we care about our customers and communities.

100-YEAR LIMITED WARRANTY
On all PlayBooster®, PlayShaper® and PlaySense® aluminum posts, stainless steel fasteners, clamps, beams and caps, against structural failure due to corrosion/natural deterioration or manufacturing defects, and on PlayBooster, Evos™ and Weevos™ steel posts and arches against structural failure due to material or manufacturing defects.

15-YEAR LIMITED WARRANTY
On all plastic components (including TuffTimbers™ edging), all steel components (except 100-year steel posts), Mobius® climbers, decks and TenderTuff™ coatings (except Wiggle Ladders, Chain Ladders and Swing Chain) against structural failure due to material or manufacturing defects. TuffTurf® tiles against material or manufacturing defects.

10-YEAR LIMITED WARRANTY
On concrete products against structural failure due to natural deterioration or manufacturing defects. Does not cover minor chips, hairline cracks or efflorescence.

8-YEAR LIMITED WARRANTY
On Aeronet™ climbers and climbing cables against defects in materials or manufacturing defects. On CoolToppers® fabric against failure from significant fading, deterioration, breakdown, mildew, outdoor heat, cold or discoloration. This warranty is limited to the design loads as stated in the specifications found in the technical information.

3-YEAR LIMITED WARRANTY
On all other parts, i.e.: CableCore® products, swing seats and hangers, grills, Mobius climber handholds, Wiggle Ladders, Chain Ladders and Swing Chain, Track Ride trolleys and bumpers, all rocking equipment including Sway Fun® gliders, PVC belting material, HealthBeat™ hydraulic cylinders, Seesaws, Wiggle Ring Bridge, etc., against failure due to corrosion/natural deterioration or manufacturing defects.

This warranty does not include any cosmetic issues or wear and tear from normal use. It is valid only if the playstructures and/or equipment are erected to conform with Landscape Structures' installation instructions and maintained according to the maintenance procedures furnished by Landscape Structures Inc. For a full text of the warranty, contact your playground consultant.

Material Specifications
Quote: meo15526 PlayBooster® (5-12 years)
8/5/2016

General Specifications:

Material: All materials shall be structurally sound and suitable for safe play. Durability shall be ensured on all steel parts by the use of time-tested coatings such as zinc plating, galvanizing, ProShield finish, TenderTuff coating, etc. Colors shall be specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F879 unless otherwise indicated (see specific product installation/specifications). All primary fasteners shall include a locking patch-type material that will meet the minimum torque requirements of IFI-125. Manufacturer to provide special tools for pinned tamperproof fasteners.

TenderTuff Coating: Metal components to be TenderTuff-coated shall be thoroughly cleaned in a hot phosphatizing pressure washer, then primed with a water-based thermosetting solution. Primed parts shall be preheated prior to dipping in UV-stabilized, liquid polyvinyl chloride (PVC), then salt cured at approximately 400 degrees fahrenheit (200 degrees celsius). The finished coating shall be approximately .080" (2,03 mm) thick at an 85 durometer with a minimum tensile strength of 1700 PSI (11721,09 Kilopascals)and a minimum tear strength of 250 pounds/inch (0.028 kilonewton meters). Five standard colors are available all with a matte finish. (Brown only for HealthBeat). Not applicable for Evos.

ProShield Finish: All metal components with ProShield finish shall be thoroughly cleaned and phosphatized through a five-stage power washer. Parts are then thoroughly dried, preheated and processed through a set of automatic powder spray guns where a minimum .002" (0,05 mm) of epoxy primer is applied. A minimum .004” (0,10 mm) of architectural-grade Super-Durable polyester TGIC powder is applied. The average ProShield film thickness is .006" (1,52 mm).

ProShield is formulated and tested per the following ASTM standards. Each color must meet or exceed the ratings listed below:

Hardness (D3363) rating 2H
Flexibility (D522) pass 1/8" (3,17 mm) mandrel
Impact (D2794) rating minimum 80 inch-pounds (9.038 newton meters)
Salt Fog Resistance (B117 and D1654) 4,000 hours and rating 6
or greater
UV Exposure (G154, 340 bulb) 3,000 hours, rating delta E of 2,
and 90 percent gloss retention
Adhesion (D3359, Method B) rating 5B

The Paint Line shall employ a "checkered" adhesion test daily.

26 standard colors are available.

Decks: All Tenderdecks shall be of modular design and have 5/16" (7,92 mm) diameter holes on the standing surface. There shall be a minimum of (4) slots in each face to accommodate face mounting of components. Tenderdecks shall be manufactured from a single piece of low carbon 12 GA (.105") (2,66 mm) sheet steel conforming to ASTM specification A-1011. The sheet shall be perforated with a return flange on the perimeter to provide the reinforcement to ensure structural integrity. There shall be no unsupported

area larger than 3.5 square feet (0.3251 square meters). The unit shall then be TenderTuff-coated brown or gray only. Tenderdecks shall be designed so that all sides are flush with the outside edge of the supporting posts. Not applicable for Evos, Weevos or HealthBeat.

Rotationally Molded Polyethylene Parts: These parts shall be molded using prime compounded linear low-density polyethylene with a tensile strength of 2500 psi (17236,9 kilopascals) per ASTM D638 and with color and UV-stabilizing additives. Wall thickness varies by product from .187" (3/16") (4,75 mm) to .312" (5/16") (7,92 mm). Five standard colors are available (Black only for HealthBeat).

Permalene Parts: These parts shall be manufactured from 3/4" (19,05 mm) high-density polyethylene that has been specially formulated for optimum UV stability and color retention. Products shall meet or exceed density of .960 G/cc per ASTM D1505, tensile strength of 2400 PSI (16547,42 kilopascals) per ASTM D638. Five standard solid colors are available. Some Permalene parts are available in a two-color product with (2) .100" (2,54 mm) thick exterior layers over a .550" (13,97 mm) interior core of a contrasting color. Eight standard two-color options are available. Not applicable for Evos or HealthBeat.

Recycled Permalene® Parts: These parts shall be manufactured from 3/4" (19,05 mm) high-density polyethylene that has been specially formulated for optimum UV stability and color retention. Products shall meet or exceed density of .960 G/cc per ASTM D1505, tensile strength of 2400 PSI (16547,42 Kilopascals) per ASTM D638. Available in a three-layer product with (2) .100" (2,54 mm) thick colored exterior layers over a .550" (13,97 mm) thick 100% recycled Black interior core. Eleven standard color options are available. Not applicable for Evos or HealthBeat.

Footings: Unless otherwise specified, the bury on all footings shall be 34" (864 mm) below Finished Grade (FG) on all in-ground play events/posts. Other types of anchoring are available upon request.

Hardware Packages: All shipments shall include individual component-specific hardware packages. Each hardware package shall be labeled with the part number, description, a component diagram showing the appropriate component, package weight, a bar code linking the hardware package to the job number, assembler's name, date and time the package was assembled, work center number, and work order number.

Installation Documentation: All shipments shall include a notebook or packet of order-specific, step-by-step instructions for assembly of each component, including equipment assembly diagrams, estimated hours for assembly, footing dimensions, concrete quantity for direct bury components, fall height information, area required information and detailed material specifications.

Packing List: All shipments shall include a packing list for each skid/container, specifying the part numbers and quantities on each skid or within each container.

Packaging: PlayBooster posts shall be individually packaged in sturdy, water-resistant, mar-resistant cardboard boxes. Other components shall be individually wrapped or bulk wrapped to provide protection during shipment. Small parts and hardware packages will be placed in crates for shipment. The components and crates are then shrink-wrapped to skids (pallets) to ensure secure shipping.

Maintenance Kit: An order-specific maintenance kit shall be provided for each structure order. The kit will include a notebook or packet with a second set of installation documents and order-specific maintenance documentation with recommendations on how often to inspect, what to look for and what to do to keep the equipment in like-new condition. The kit also includes touch-up primer, appropriate color touch-up

paint, sandpaper, appropriate color touch-up PVC, graffiti remover and additional installation tools for the tamperproof fasteners.

(PB) General Specifications:

Posts: Post length shall vary depending upon the intended use and shall be a minimum of 42" (1067 mm) above the deck height. All posts shall be ProShield finished to specified color. All posts shall have a "finished grade marker" positioned on the post identifying the 34" (864 mm) bury line required for correct installation and the top of the loose fill protective surfacing. Top caps for posts shall be aluminum die cast from 369.1 alloy and ProShield finished to match the post color. All caps shall be factory installed and secured in place with (3) self sealing rivets. A molded low-density polyethylene cap, with drain holes, shall be pressed onto the bottom end of the post to increase the footing area.

Steel Posts: All steel PlayBooster posts are manufactured from 5" (127 mm) O.D. tubing with a wall thickness of .120" (3,04 mm) and shall be galvanized after rolling and shall have both the I.D. and the cut ends sprayed with a corrosion resistant coating.

Steel Post Mechanical Properties:
Yield Strength (min): 50,000 PSI (344737,95 Kilopascals)
Tensile Strength (min): 55,000 PSI (379211,75 Kilopascals)
% Elongation in 2 inches (51 mm): 25
Modulus of Elasticity: 29.5 x 1,000,000 PSI
(6894759,09 Kilopascals).

Aluminum Posts: All aluminum PlayBooster posts are manufactured from 6005-T5 extruded tubing conforming to ASTM B-221. Posts shall have a 5" (127 mm) outside diameter with a .125" (3,17 mm) wall thickness.

Aluminum Post Mechanical Properties:
Yield Strength (min): 35,000 PSI (241316,57 Kilopascals)
Tensile Strength (min): 38,000 PSI (262000,85 Kilopascals)
% Elongation in 2 inches (51 mm): 10
Modulus of Elasticity: 10 x 1,000,000 PSI
(6894759,09 Kilopascals)

Arch Posts: Aluminum arch posts shall be manufactured from 6005-T5 alloy. The arch shall be formed to a 21" (533 mm) center line radius to complement the 42" (1067 mm) center to center module. The arch shall be of one continuous piece construction. There shall be no welds or additional pieces mechanically fastened to manufacture the arch. Each arch shall be designed to provide a minimum of 90 1/2" (2298,7 mm) clear span from the deck to the inside of the arch at the radius peak. Arches shall be proShield finished to a specified color.

Clamps: All clamps are ProShield finished and, unless otherwise noted, shall be die cast using a 369.1 aluminum alloy and have the following mechanical properties:
Ultimate Tensile: 47,000 PSI (324053,68 Kilopascals)
Yield Strength: 28,000 PSI (193053,25 Kilopascals)
Elongation: 7% in 2 inches
Shear Strength: 29,000 PSI (199948,01 Kilopascals)
Endurance Limit: 20,000 PSI (137895,18 Kilopascals)

Each functional clamp assembly shall have an appropriate number of half clamps and shall be fastened to mating parts with (2) 3/8" (9,53 mm) x 1 1/8" (28,58 mm) pinned button head cap screws (SST) and (2) stainless steel (SST) recessed "T" nuts. A 1/4" (6,35 mm) aluminum drive rivet w/stainless steel pin is used to ensure a secure fit to the post.

PlayBooster clamps have three functional applications and shall be named as follows:

1.) Offset hanger clamp assembly.
2.) Deck hanger clamp assembly.
3.) Hanger clamp assembly.

Cable: Made of tightly woven polyester-wrapped, six-stranded galvanized-steel cable with a polypropylene core, color specified.

PlayOdyssey Structural Frame: Post length of the double ladder/central column shall vary depending upon the deck height and shall be flush with the bottom of a deck infill or a minimum of 46" (1168 mm) above the deck height. All posts shall be ProShield finished to specified color. All posts shall have a "finished grade marker" positioned on the post identifying the 60" (1524 mm) bury line required for correct installation and the top of the loose fill protective surfacing. Post caps shall be aluminum die cast from 369.1 alloy and ProShield finished to match the post color. All caps shall be factory installed and secured in place with (3) self sealing rivets. A molded low-density polyethylene cap, with drain holes, shall be pressed onto the bottom end of the ladder posts to increase the footing area. Ladders are bolted together below grade to act as a single column for installation purposes. The deck support weldments/arms are comprised of 5/16" (.312") (7,92 mm) steel conforming to 1010 steel per ASTM A635 and welded to a 52" (1321 mm) steel post. Arms are secured to each ladder post with (4) 5/8" (15,88 mm) x 1 1/2" (38,1 mm) pinned button head cap screws thru (2) 1/4" (6,35 mm) flanges.

PlayOdyssey Optional Aluminum Roof Posts: All formed aluminum PlayOdyssey roof posts are manufactured from 6005-T5 extruded tubing conforming to ASTM B-221. Posts shall have a 5" (127 mm) outside diameter with a .125" (3,17 mm) wall thickness. Post sleeve shall have 4.675" (118,75 mm) outside diameter with a .150" (3,81 mm) wall thickness. Post cap shall be aluminum die cast from 369.1 alloy and ProShield finished to match the post color. All caps shall be factory installed and secured in place with (3) self sealing rivets.

Material Specifications:

120211A

90*Curved Bridge 48"Dk DB

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Barrier: Weldment comprised of 5/8" (15,88 mm) solid steel vertical rails, 1 1/8" (28,58 mm) O.D. x 11 GA (.120") (3,04 mm) steel horizontal rails top and bottom with a 3 1/4" (82,55 mm) space between vertical members. Finish: TenderTuff, color specified.

Support: Fabricated from 2.375" (60,33 mm) O.D. RS-20 (.120" - .130") (3,04 mm-3,30 mm) galvanized steel tubing. Finish: ProShield, color specified.

Bridge: Weldment comprised of 12 GA (.105") (2,67 mm) HRPO sheet steel conforming to ASTM A1011 and 3/16" (4,75 mm) HRPO sheet steel. Standing surface is perforated with 5/16" (7,92 mm) diameter holes. Finish: TenderTuff, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

116249B

Vertical Ladder 48"Dk DB

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Vertical Ladder: Weldment comprised of 1.125" ((28,58 mm) O.D. x 11 GA (.120") (3,04 mm) steel tubing, 1.029" (26,14 mm) O.D. RS-20 (.070" - .080") (1,78 mm-2,03 mm) and 3/16" x 2" (4,75 mm x 51 mm) wide steel flat plates. Finish: TenderTuff, color specified.

Footer: Fabricated from 1.315" (33,40 mm) O.D. RS-20 (.080" - .090") (2,03 mm-2,28 mm) galvanized steel tubing. Finish: ProShield, color specified.

Handhold Panel: Permalene, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

116249D

Vertical Ladder 72"Dk DB

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Vertical Ladder: Weldment comprised of 1.125" ((28,58 mm) O.D. x 11 GA (.120") (3,04 mm) steel tubing, 1.029" (26,14 mm) O.D. RS-20 (.070" - .080") (1,78 mm-2,03 mm) and 3/16" x 2" (4,75 mm x 51 mm) wide steel flat plates. Finish: TenderTuff, color specified.

Footer: Fabricated from 1.315" (33,40 mm) O.D. RS-20 (.080" - .090") (2,03 mm-2,28 mm) galvanized steel tubing. Finish: ProShield, color specified.

Handhold Panel: Permalene, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

143198A

Corner Climber 72"Dk DB

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Support Tube: Weldment comprised of 1.900" (48,26 mm) O.D. RS-20 (.090" - .100") (2,28 mm-2,54 mm) galvanized steel tubing, 1/8" x 1 1/2" (3,17 mm-38.1 mm) HR flat steel and 1/4" (6,35 mm) HRPO flat steel. Finish: ProShield, color specified.

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Z-Bracket: Fabricated from 7 GA. (.179") (4,55 mm) sheet HRPO steel. Finish: ProShield, color specified.

Hand Grip: Made from Polyester Resin. Hand Grips measure 5 3/4" (146,05 mm) long x 2 1/2" (63,5 mm) wide x 1 3/4" (44,45 mm) high.

Mounting Plate: Fabricated from 1/8" (3,17 mm) HR flat steel. Finish: ProShield, green in color.

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Side Frame: Weldment comprised of 1.900" (48,26 mm) O.D. RS-20 (.090" - .100") (2,28 mm-2,54 mm) galvanized steel tubing, 1/8" x 1" (3,17 mm x 25 mm) HR flat steel and 1/4" x 1 3/4" (6,35 mm x 44,45 mm) wide steel clamp. Finish: ProShield, color specified.

Corner Belt: PVC belting , 5/16" (7,92 mm) thick, 300 PIW tension rating.

Center & Corner Panels: One-color Permalene, color specified.

Corner Flange: Fabricated from 1/8" x 1" (3,17 mm x 25 mm) HR flat steel. Finish: ProShield, color specified.

145108A

Manta Ray Climber w/Perm Handholds 48"Dk DB Only Between One Square Configurations and One Hex

Anchor Bar: Weldment comprised of 1/2" x 3" (12,7 mm x 76 mm) flat steel and 1/4" x 8" (6,35 mm x 203 mm) square plate. Finish: Galvanized.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Net Clamp: Weldment comprised of 1/4" x 1 3/4" (6,35 mm x 44,45 mm) HRPO flat steel and .375" (9,53 mm) stainless steel sheet. Finish: ProShield, color specified.

Net Face Plate: Fabricated from 1/4" (6,35 mm) HRPO sheet steel. Finish: ProShield, color specified.

Net: Made of tightly woven polyester-wrapped, six-stranded galvanized-steel cable with a polypropylene core, color specified. Connector fabricated from 1.250" O.D. 6063-T6 aluminum.

Clamps: Cast aluminum. Finish: ProShield, color specified.

Handhold Panel: Permalene, color specified.

152907B

Deck Link w/Barriers Steel end panels 2 Steps

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Barrier: Weldment comprised of 1.125" (28,58 mm) O.D. x 11 Ga. (.120") (3,04 mm) wall steel tubing, 5/8" (15,88 mm) O.D. steel bar with 203 or 303 stainless steel 3/8" (9,53 mm)threaded inserts. Finish: TenderTuff, color specified.

Step Section: Formed from 12 GA (.105") (2,66 mm) sheet steel comforming to ASTM A1011. Standing surface is 24 1/4" (615,95 mm) wide x 14" (356 mm) deep and is perforated with 5/16" (7,94 mm) diameter holes. Finish: TenderTuff, color specified.

SteelX Panels: Zinc plated 7 GA (.179") (4,55 mm) HRPO flat steel. Finish: ProShield, color specified.

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Clamps: Cast aluminum. Finish: ProShield, color specified.

153350B

Chain Ladder 48"Dk DB

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Ladder: Comprised of 4/0 zinc plated chain. Finish: TenderTuff, color specified, and 13/16" (20,64 mm) O.D. 6061 aluminum rails.

Clamps: Cast aluminum. Finish: ProShield, color specified.

Handhold Panel: Permalene, color specified.

Support (DB): Weldment comprised of 1.900" (48,26 mm) O.D. RS-20 (.090" - .100") (2,28 mm-2,54 mm) galvanized steel tubing and 11 GA (.120") (3,04 mm) x 4" (102 mm) x 30" (762 mm) zinc plated steel strap. Finish: ProShield, color specified.

176078A

Lollipop Climber 48"Dk DB

Clamps: Cast aluminum. Finish: ProShield, color specified.

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Handhold Panel: Permalene, color specified.

Handhold Panel: Permalene, color specified.

Lollipop Climber: Weldment comprised of 1.315" (33,40 mm) O.D. RS20 (.080"-.090") (2,03 mm-2,28 mm) wall galvanized steel tube, 2.375" (60,33 mm) O.D. RS20 (.095"-.105") (2,41 mm-2,66 mm) wall galvanized steel tube, 1/4" (6,35 mm) HRPO steel sheet and 10 GA. (.135") (3,43 mm) HRPO steel. Finish: ProShield, color specified.

111228A

Square Tenderdeck

Square Deck: Flange formed from 12 GA (.105") (2,66 mm) sheet steel conforming to ASTM A1011. Standing surface is perforated with 5/16" (7,92 mm) diameter holes. Deck face has (4) slotted holes for face mounting components. The finished size measures 2 5/8" x 47" x 47" (66,68 mm x 1194 mm x 1194 mm). Finish: TenderTuff, color specified.

Deck Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

111231A

Triangular Tenderdeck

Triangular Deck: Flange formed from 12 GA (.105") (2,66 mm) sheet steel conforming to ASTM A1011. Standing surface is perforated with 5/16" (7,92 mm) diameter holes. Deck face has (4) slotted holes for face mounting components. The finished size measures 2 5/8" x 37 3/4" (66,68 mm x 958,85 mm). Finish: TenderTuff, color specified.

Deck Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

119646A

Tri-Deck Extension

Triangular Deck Extension: Flange formed from 12 GA (.105") (2,66 mm) sheet steel conforming to ASTM A1011. Standing surface is perforated with 5/16" (7,92 mm) diameter holes. Deck face has (4) slotted holes for face mounting components. The finished size of two of the three sides measures 2 5/8" x 37 7/8" (66,68 mm x 962,03 mm) on the face of the deck and the other side measures 2 5/8" x 43 3/4" (66,68 mm x 1111,25 mm). Finish: TenderTuff, color specified.

Deck Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

121949A

Tri-Deck Kick Plate 8"Rise

Kick Plate: Fabricated from 11 GA (.120") (3,04 mm) HR flat steel. Finish: TenderTuff, brown or gray in color.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

122197A

90* Triangular Tenderdeck

Triangular Deck: Flange formed from 12 GA (.105") (2,66 mm) sheet steel conforming to ASTM A1011. Standing surface is perforated with 5/16" (7,92 mm) diameter holes. Deck face has (4) slotted holes for face mounting components. The finished size measures 2 5/8" x 37 3/4" (66,68 mm x 958,85 mm). Finish: TenderTuff, color specified.

Deck Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

152911B

Curved Transfer Module Left 40"Dk DB

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Railings: Weldment comprised of 1.125" (28,58 mm) O.D. x 11 GA. (.120") (3,04 mm) steel tubing with 203 or 303 stainless steel 3/8" (9,53 mm) threaded inserts. Finish: TenderTuff, color specified.

Step Support: Weldment comprised of 1.660" (42,16 mm) O.D. RS-20 (.080" - .095") (2,03 mm-2,41 mm) galvanized steel tubing and 1 3/4" x 1 3/4" x 1/8" (44,45 mm x 44,45 mm x 3,17 mm) HR angle. Finish: ProShield, color specified.

Step Sections/Top Step Section: Formed from 12 GA (.105") (2,66 mm) HRPO sheet steel conforming to ASTM A1011. Standing surface is 24 3/8" (619,13 mm) wide x 14" (355,6 mm) deep and is perforated with 5/16" (7,92 mm) diameter holes. Finish: TenderTuff, color specified.

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Deck Support: Weldment comprised of 3 1/2" (88,9 mm) O.D. RS-20 (.125") (3,17 mm) galvanized steel tubing and 3/8" (9,53 mm) O.D. x 5" (127 mm) long CRS rod. Finish: ProShield, color specified.

Deck: Flange formed from 12 GA (.105") (2,66 mm) HRPO sheet steel conforming to ASTM A1011. Standing surface is perforated with 5/16" (7,92 mm) diameter holes and measures 29" (737 mm) per (2) sides. Finish: TenderTuff, color specified.

Panels: Permalene, color specified.

Clamps: Cast aluminum. Finish: ProShield, color specified.

111240A

Balcony Deck

Barrier: Weldment comprised of 5/8" (15,87 mm) solid steel vertical rails, 1 1/8" (28,57 mm) O.D. steel horizontal rails with 203 or 303 stainless steel welded inserts with 5/8" (15,87 mm) internal threads. Finish: TenderTuff, color specified.

Deck: Fabricated from 12 GA (.105") (2,66 mm) sheet steel conforming to ASTM A1011. Standing surface is perforated with 5/16" (7,93 mm) diameter holes perforated. The finished size measures 2 5/8" x 34" (66,67 mm x 863 mm) (straight edge) x 17" (431 mm) radius (curved edge). Finish: TenderTuff, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

115236A

Ball Maze Panel Above Deck

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Permalene Panel: Two color panel measures 35 5/8" (904,88 mm) wide x 41" (1041 mm) high, color specified.

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Angled Panel Bracket: Weldment comprised of .190" (4,83 mm) thick 5052 aluminum formed angle with (2) 6005-T5 aluminum threaded tubes 1 1/8" (28,58 mm) O.D. x 1 1/2" (38,1 mm) long. Finish: ProShield, color specified.

Ball: 1/2" (12,7 mm) diameter, SST.

Cover: Made from .177" (4,50 mm) thick x 18 5/16" (465,12 mm) diameter clear polycarbonate.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

119514A

Pilot Panel Above Deck

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Permalene Panel: Two color panel measures 35 5/8" (904,88 mm) wide x 41" (1041 mm) high, color specified.

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Wheel: 12" (305 mm) diameter cast A319.1 aluminum alloy. Shaft-303 stainless steel. Finish: TenderTuff, color specified.

Wheel Bracket: Weldment comprised of formed 3/16" (4,75 mm) plate and 5/8" (15,88 mm) O.D. stainelss steel shaft. Finish: ProShield, color specified.

Angled Panel Bracket: Weldment comprised of .190" (4,83 mm) thick 5052 aluminum formed angle with (2) 6005-T5 aluminum threaded tubes 1 1/8" (28,58 mm) O.D. x 1 1/2" (38,1 mm) long. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

159459A

Ring-A-Bell Panel Above Deck

Bell: Fabricated from 10 GA. (.135") (3,42 mm) HRPO low carbon steel. Finish: ProShield, color specified.

Bell Striker: Recycled Permalene, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Permalene Panel: Two color panel measures 35 5/8" (904,88 mm) wide x 41" (1041 mm) high, color specified.

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Angled Panel Bracket: Weldment comprised of .190" (4,83 mm) thick 5052 aluminum formed angle with (2) 6005-T5 aluminum threaded tubes 1 1/8" (28,58 mm) O.D. x 1 1/2" (38,1 mm) long. Finish: ProShield, color specified.

164092A

Bongo Panel Above Deck

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Clamps: Cast aluminum. Finish: ProShield, color specified.

Screen Plate: Fabricated from 12 GA. (.105") (2,66 mm) HRPO flat steel. Finish: Black in color.

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Permalene Panel: Two color panel measures 35 5/8" (904,88 mm) wide x 41" (1041 mm) high, color specified.

Bongo: Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Angled Panel Bracket: Weldment comprised of .190" (4,83 mm) thick 5052 aluminum formed angle with (2) 6005-T5 aluminum threaded tubes 1 1/8" (28,58 mm) O.D. x 1 1/2" (38,1 mm) long. Finish: ProShield, color specified.

173567A

Marble Panel Above Deck

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Angled Panel Bracket: Weldment comprised of .190" (4,83 mm) thick 5052 aluminum formed angle with (2) 6005-T5 aluminum threaded tubes 1 1/8" (28,58 mm) O.D. x 1 1/2" (38,1 mm) long. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Marble Panel Assy.: (Panels) Two color Permalene, color specified. (Poly Panel) Fabricated from .236" (5,99 mm) thick clear polycarbonate. (Marbles) 2" (51 mm) Diameter glass.

177718A

Rain Sound Wheel Panel Above Deck

Rain Sound
Wheel Panel Assy.: Assembly comprised of (Permalene Panels), color specified. (Shaft) 1" (25 mm) diameter x 4 3/4" (120,65 mm) long stainless steel. (Inner & Outer Rings) 16 GA. (.059") (1,50 mm) HRPO sheet steel. Finish: ProShield, color specified. (Brackets) 16 GA. (.059") (1,50 mm) HRPO sheet steel. Finish: Zinc plate with clear chromate finish. (Spacer) 3/4" (19,05 mm) diameter x 2 1/8" (53,98 mm) long stainless steel. (Flange Oilite Bearing) 1.625" (41,28 mm) diameter x 1.000" (25 mm) long.

Hub: Fabricated from 1/4" (6,35 mm) thick HRPO sheet steel. Finish: ProShield, color specified.

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Panel: Permalene panel measures 35 5/8" (904,87 mm) wide x 41" (1041 mm), color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Angled Panel Bracket: Weldment comprised of .190" (4,83 mm) thick 5052 aluminum formed angle with (2) 6005-T5 aluminum threaded tubes 1 1/8" (28,58 mm) O.D. x 1 1/2" (38,1 mm) long. Finish: ProShield, color specified.

120818A

Playstructure Seat

Seat: Flange formed from 11 GA (.120") (3,04 mm) sheet steel. Seating surface is perforated with 1/4" (6,35 mm)diameter holes. Finish: TenderTuff, color specified.

Deck Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

193174A

Sol Spinner DB

Sol Spinner: Weldment comprised of 1.900" (48,26 mm) O.D. RS20 (.090"-.100")(2,29 mm-2,54 mm) wall galvanized steel tube, 1.660" (42,16 mm) O.D. RS40 (.111"-.121")(2,82 mm-3,07 mm) wall galvanized steel tube, 1/4" (6,35 mm) HRPO steel plate, 3/8" (9,53 mm) HRPO steel plate, 2.750" (69,85 mm) O.D. 1018 steel, and 1 7/8" (47,63 mm) steel ball. Finish: ProShield, color specified.

Support Arm: Weldment comprised of 2.375" (60,33 mm) O.D. RS40 (.130"-.140")(3,30 mm - 3,56 mm) wall galvanized steel tube, 2.750" (69,85 mm) O.D. 1018 steel, and 1/4" (6,35 mm) HRPO flat steel. Finish: ProShield®, color specified.

GripX Panels: Permalene®, black in color.

Bushing: Oil-filled UHMW PE.

Footer: Weldment comprised of 2.375" (60,32 mm) O.D. RS40 (.130"-.140") (3,30 mm-3,56 mm) wall galvanized steel tube, 12 GA. (.105") (2,66 mm) HR flat steel and 1 7/8" (47,62 mm) steel ball. Finish: ProShield, color specified.

Clamps: Cast aluminum. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

193170A

LolliLadder w/2 E-Pods

Rung Cap: EPDM, black in color.

Clamps: Cast aluminum. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

E-Pod Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Pod: Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Pod Casting: Fabricated from sand cast alloy 356 in accordance with ASTM B26. Finish: ProShield, color specified.

LolliLadder: Weldment comprised of 1/4" (6,35 mm) HRPO flat steel, 2.375" (60,33 mm) O.D. RS40 (.130"-.140") (3,30 mm-3,55 mm) wall galvanized steel tubing, and 1.315" (33,40 mm) O.D. RS20 (.080"-.090") (2,03 mm-2,29 mm) wall galvanized tubing. Finish: ProShield®, color specified.. Finish: ProShield, color specified.

111404P

124"Steel Post DB

Post: See PlayBooster (PB) General Specifications.

111404O

132"Steel Post DB

Post: See PlayBooster (PB) General Specifications.

111404Z

182"Steel Post DB (44" Bury)

Post: See PlayBooster (PB) General Specifications.

111404E

116"Alum Post DB

Post: See PlayBooster (PB) General Specifications.

111404D

124"Alum Post DB

Post: See PlayBooster (PB) General Specifications.

111404A

148"Alum Post DB

Post: See PlayBooster (PB) General Specifications.

No Material Spec for 111404K

123337A

Single Slide 48"Dk DB

Exit Support: Weldment comprised of 2.375" (60,33 mm) O.D. RS-20 (.095" - .105") (2,41 mm x 2,66 mm) galvanized steel tubing and 1/4" x 3" (6,35 mm x 76 mm) mounting plate. Finish: ProShield, color specified.

Rail Spacer: Fabricated from 1.312" (33,32 mm) O.D. x 16 Ga. (.065") (1,65 mm) steel tubing. Finish: ProShield, color specified.

Slide: Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Rail: Extruded from 1.125" ((28,58 mm) O.D. x .312" (7,92 mm) wall. 6005-T5 aluminum. Finish: ProShield, color specified.

Slide Hood: Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

124863G

SlideWinder2 96"Dk DB Only 1 Straight 3 Right 1 Left

Rail Spacer: Fabricated from 1.312" (33,32 mm) O.D. x 16 Ga. (.065") (1,65 mm) steel tubing. Finish: ProShield, color specified.

Rail: 1 1/8" (28,58 mm) O.D. 6061-T6 aluminum extrusion with 5/16" (7,92 mm) walls. Finish: ProShield, color specified.

Slide Sections: Rotationally molded from U.V. stabilized linear low density polyethylene, color specified.

Exit Footer: Weldment comprised of 2.375" (60,33 mm) O.D. RS-20 (.095" - .105") (2,41 mm-2,66 mm) galvanized steel tubing and 1/4" x 3" x 7 1/2" (6,35 mm x 76 mm x 191 mm) HRPO steel mounting plate. Finish: ProShield, color specified.

Mid-Support: Weldment comprised of 1.900" (48,26 mm) O.D. RS20 (.090" - .100") (2,28 mm-2,54 mm) galvanized steel tubing and 7 GA. (.179") (4,54 mm) HRPO steel strap. Finish: ProShield, color specified.

Support Base (SM): Weldment comprised of 1.660" (42,16 mm) O.D. RS-20 (.085" - .095") (2,16 mm-2,41 mm) galvanized steel tubing and 1/4" x 3" x 8" (6,35 mm x 76 mm x 203 mm) mounting plate. Finish: ProShield, color specified.

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

148426A

Firepole Perm Handholds 48"Dk DB

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Firepole: Weldment comprised of 1.900" (48,26 mm) O.D. RS-20 (.090"-.100") (2,28 mm-2,54 mm) galvanized steel tubing, and 1.315" (33,40 mm) O.D. RS-20 (.080"-.090") (2,03 mm-2,28 mm) galvanized steel tubing. Finish: ProShield, color specified.

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Handhold Panel: Recycled Permalene, color specified.

174018A

Belt Seat ProGuard Chains for 8' Beam Height

Chain/ProGuard: Steel 3/16" (4,75 mm) straight link chain, 800 lb. (362,87 kilograms) working load limit. Finish: ProGuard.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Bolt Link: Stainless Steel

Belt Seat: Molded from UV stabilized black EPDM rubber encapsulating a weldment comprised of a 22 GA (.029") (0,74 mm) spring stainless steel sheet and (4) .105" (2,67 mm) thick stainless steel washers. The belt seat elliptical shape measures 7" (178 mm) wide x 26" (660 mm) long x .700" (17,78 mm) thick.

176038A

Full Bucket Seat ProGuard Chains for 8' Beam Height

Full Bucket Seat: Made of U.V. stabilized high-quality black rubber encapsulating a 24 GA (.024") (0,61 mm) stainless steel reinforcement plate. Handles cast from 356-T6 aluminum alloy with black polyarmor paint finish. Handles attach to seat with (3) 1/4" (6,35 mm) x 1 5/16" (33,32 mm) long stainless steel rivets. The full bucket measures 9" (229 mm) deep x 10 1/2" (266,7 mm) wide.

Chain/ProGuard: Steel 3/16" (4,75 mm) straight link chain, 800 lb. (362,87 kilograms) working load limit. Finish: ProGuard.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

177332A

Single Post Swing Frame 8' Beam Height Only

Beam: Weldment comprised of 2.375" (60,33 mm) O.D. RS-40 (.130" - .140") (3,30 mm-3,56 mm) galvanized steel tubing, 3" (76 mm) wide zinc-plated steel clamps and 1 1/4" (31,75 mm) housings w/bronze bushings. Finish: ProShield, color specified.

Post: See PlayBooster (PB) General Specifications.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Half Clamp: Cast aluminum. Finish: ProShield, color specified.

177333A

Single Post Swing Frame Additional Bay 8' Beam Height Only

Beam: Weldment comprised of 2.375" (60,33 mm) O.D. RS-40 (.130" - .140") (3,30 mm-3,56 mm) galvanized steel tubing, 3" (76 mm) wide zinc-plated steel clamps and 1 1/4" (31,75 mm) housings w/bronze bushings. Finish: ProShield, color specified.

Post: See PlayBooster (PB) General Specifications.

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Half Clamp: Cast aluminum. Finish: ProShield, color specified.

129042A

Offset Crawl Tunnel 24"Offset Deck To Deck

Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).

Attachment Blocks: U.V. stabilized high-density polyethylene, color specified.

Tunnel Section: Rotationally molded from U.V. stabilized linear low-density polyethylene, color specified.

Spacer Tube: Made from 6061-T6 aluminum 7/8" (22,23 mm) O.D. x 1 11/16" (42,85 mm). Finish: ProShield, color specified.

Foot Strip: One-color Permalene, green in color.

Offset Hanger Clamp Assembly: Cast aluminum. Finish: ProShield, color specified.

Angled Panel Bracket: Weldment comprised of .190" (4,83 mm) thick 5052 aluminum formed angle with (2) 6005-T5 aluminum threaded tubes 1 1/8" (28,58 mm) O.D. x 1 1/2" (38,1 mm) long. Finish: ProShield, color specified.

Permalene Panels: One-color panel measures 35 5/8" (904,88 mm) wide x 41" (1041 mm) high, & 35 5/8" (904,88 mm) wide x 47 7/8" (1216,03 mm) high, color specified.

Warranty: You have our word.

More than just a contract, our warranty is our personal commitment that you'll be satisfied with your purchase now and well into the future. As an employee-owned company we take great pride in the quality of everything we make. And we're so confident that you'll be delighted with your purchase that we back our products with the most comprehensive long-term warranties in the industry. It's just one more way that we show how much we care about our customers and communities.

100-YEAR LIMITED WARRANTY
On all PlayBooster®, PlayShaper® and PlaySense® aluminum posts, stainless steel fasteners, clamps, beams and caps, against structural failure due to corrosion/natural deterioration or manufacturing defects, and on PlayBooster, Evos™ and Weevos™ steel posts and arches against structural failure due to material or manufacturing defects.

15-YEAR LIMITED WARRANTY
On all plastic components (including TuffTimbers™ edging), all steel components (except 100-year steel posts), Mobius® climbers, decks and TenderTuff™ coatings (except Wiggle Ladders, Chain Ladders and Swing Chain) against structural failure due to material or manufacturing defects. TuffTurf® tiles against material or manufacturing defects.

10-YEAR LIMITED WARRANTY
On concrete products against structural failure due to natural deterioration or manufacturing defects. Does not cover minor chips, hairline cracks or efflorescence.

8-YEAR LIMITED WARRANTY
On Aeronet™ climbers and climbing cables against defects in materials or manufacturing defects. On CoolToppers® fabric against failure from significant fading, deterioration, breakdown, mildew, outdoor heat, cold or discoloration. This warranty is limited to the design loads as stated in the specifications found in the technical information.

3-YEAR LIMITED WARRANTY
On all other parts, i.e.: CableCore® products, swing seats and hangers, grills, Mobius climber handholds, Wiggle Ladders, Chain Ladders and Swing Chain, Track Ride trolleys and bumpers, all rocking equipment

including Sway Fun® gliders, PVC belting material, HealthBeat™ hydraulic cylinders, Seesaws, Wiggle Ring Bridge, etc., against failure due to corrosion/natural deterioration or manufacturing defects.

This warranty does not include any cosmetic issues or wear and tear from normal use. It is valid only if the playstructures and/or equipment are erected to conform with Landscape Structures' installation instructions and maintained according to the maintenance procedures furnished by Landscape Structures Inc. For a full text of the warranty, contact your playground consultant.

APPENDIX F

SPORTS LIGHTING MANUFACTURER SPECIFICATIONS AND DETAILS

Control System Summary

Project Specific Notes:

Project Information

Project #:	154869
Project Name:	Newton Highland Playground
Date:	08/11/16
Project Engineer:	JBrown
Sales Representative:	Mike Berry
Control System Type:	Control and Monitoring
Communication Type:	Digital Cellular
Scan:	154869-LED
Document ID:	154869P1V4-0811095555
Distribution Panel Location or ID:	Controls
Total # of Distribution Panel Locations for Project:	1
Design Voltage/Hertz/Phase:	480/60/3
Control Voltage:	120

Equipment Listing

DESCRIPTION	APPROXIMATE SIZE
1.Control and Monitoring Cabinet	24 X 72

	QTY	SIZE
Total Contactors	8	30 AMP
Total Off/On/Auto Switches:	2	

Preliminary Plans
Confirm all Details - voltage,
# of distribution panels, etc.

Materials Checklist

Contractor/Customer Supplied:

- ❑ A single control circuit must be supplied per distribution panel location.
  - — If the control voltage is NOT available, a control transformer is required.
- ❑ Electrical distribution panel to provide overcurrent protection for circuits
  - — Thermal/Magnetic circuit breaker sized per full load amps on Circuit Summary by Zone Chart
- ❑ Wiring:
  - — Dedicated control power circuit
  - — Power circuit to and from lighting contactors
  - — Harnesses for cabinets at remote locations
  - — Means of grounding, including lightning ground protection
- ❑ Electrical conduit wireway system
  - — Entrance hubs rated NEMA 4: must be die-cast zinc, PVC, or copper-free die-cast aluminum
- ❑ Mounting hardware for cabinets
- ❑ Control circuit lock-on device to prevent unauthorized power interruption to control power
- ❑ Anti-corrosion compound to apply to ends of wire, if necessary

Call Control-Link Central ™ operations center at 877/347-3319 to schedule activation of the control system upon completion of the installation. Note: Activation may take up to 1 1/2 hours

IMPORTANT NOTES

1. Please confirm that the design voltage listed above is accurate for this facility. Design voltage/phase is defined as the voltage/phase being connected and utilized at each lighting pole's ballast enclosure disconnect. Inaccurate design voltage/phase can result in additional costs and delays. Contact your Musco sales representative to confirm this item.
2. In a 3 phase design, all 3 phases are to be run to each pole. When a 3 phase design is used Musco's single phase luminaires come pre-wired to utilize all 3 phases across the entire facility.
3. One contactor is required for each pole. When a pole has multiple circuits, one contactor is required for each circuit. All contactors are UL 100% rated for the published continuous load. All contactors are 3 pole.
4. If the lighting system will be fed from more than one distribution location, additional equipment may be required. Contact your Musco sales representative.
5. A single control circuit must be supplied per control system.
6. Size overcurrent devices using the full load amps column of the Circuit Summary By Zone chart- Minimum power factor is 0.9.

NOTE: Refer to Installation Instructions for more details on equipment information and the installation requirements

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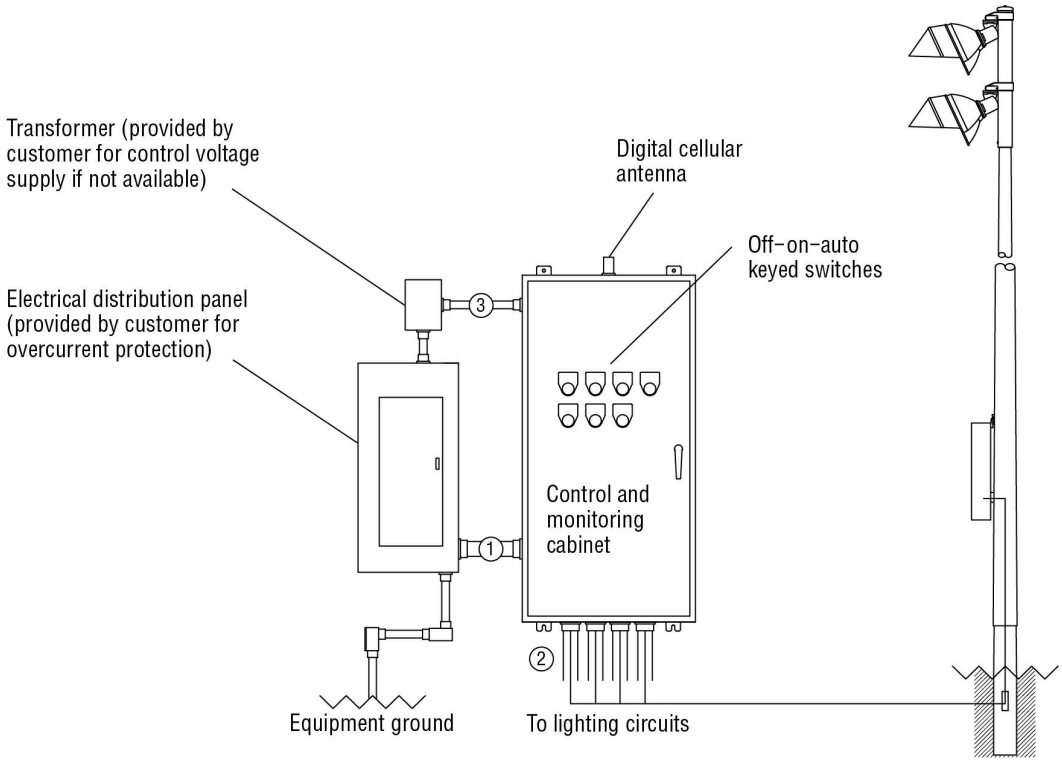
Control•Link® Control and Monitoring System



Wire	Description	# of Wires	Typ. Wire Size (AWG)	Max. Wire Length (FT)	Wire from Musco	Notes
1	Line power to contactors, and equipment grounding conductor	Note A	Note B	27	No	A – E
2	Load power to lighting circuits	Note A	Note B	N/A	No	A – D
3	Control power (dedicated, 20A)	3	12	N/A	No	C, D

R60-32-00_C

Notes:
A. Voltage and phasing per the notes on cover page.
B. Calculate per load and voltage drop.
C. All conduit diameters should be per code.
D. Refer to control and monitoring system installation instructions for more details on equipment information and the installation requirements.
E. Contact Musco if maximum wire length from circuit breaker to contactor exceeds value in chart.

IMPORTANT: Control (3) wires must be in separate conduit from line and load power wiring (1, 2).

Control System Summary

SWITCHING SCHEDULE

Field/Zone Description	Zones
Football	**1**
Softball	**2**

CONTROL POWER CONSUMPTION	
120V Single Phase	
VA loading of Musco Supplied Equipment	INRUSH: 2548.0
	SEALED: 298.8

CIRCUIT SUMMARY BY ZONE

POLE	CIRCUIT DESCRIPTION	# OF FIXTURES	# OF DRIVERS	*FULL LOAD AMPS	CONTACTOR SIZE (AMPS)	CONTACTOR ID	ZONE
F1	Football	17	9	**19.5**	30	C1	1
F2	Football	17	9	**19.5**	30	C2	1
F3	Football	17	9	**19.5**	30	C3	1
F4	Football	17	9	**19.5**	30	C4	1
A1	Softball	8	4	**7.7**	30	C5	2
A2	Softball	8	4	**7.7**	30	C6	2
B1	Softball	10	5	**10.7**	30	C7	2
B2	Softball	10	5	**10.7**	30	C8	2

*Full Load Amps based on amps per driver.

Control System Summary

PANEL SUMMARY

CABINET #	CONTROL MODULE LOCATION	CONTACTOR ID	CIRCUIT DESCRIPTION	FULL LOAD AMPS	DISTRIBUTION PANEL ID (BY OTHERS)	CIRCUIT BREAKER POSITION (BY OTHERS)
1	1	C1	Pole F1	19.52		
1	1	C2	Pole F2	19.52		
1	1	C3	Pole F3	19.52		
1	1	C4	Pole F4	19.52		
1	1	C5	Pole A1	7.74		
1	1	C6	Pole A2	7.74		
1	1	C7	Pole B1	10.69		
1	1	C8	Pole B2	10.69		

ZONE SCHEDULE

			CIRCUIT DESCRIPTION	
ZONE	SELECTOR SWITCH	ZONE DESCRIPTION	POLE ID	CONTACTOR ID
Zone 1	1	Football	F1 F2 F3 F4	C1 C2 C3 C4
Zone 2	2	Softball	A1 A2 B1 B2	C5 C6 C7 C8

Newton Highland Playground

Newton,MA

Lighting System

Pole / Fixture Summary

Pole ID	Pole Height	Mtg Height	Fixture Qty	Luminaire Type	Load	Group
A1-A2	60'	60'	5	216 LED	3.15 kW	B
		60'	1	228 LED	0.63 kW	B
		24'	2	96 LED	0.80 kW	B
B1-B2	70'	70'	4	216 LED	2.52 kW	B
		70'	4	228 LED	2.52 kW	B
		24'	2	96 LED	0.80 kW	B
F1-F4	70'	70'	5	216 LED	3.15 kW	A
		70'	10	228 LED	6.30 kW	A
		20'	2	96 LED	0.80 kW	A
8			***104***		***61.84 kW***	

Group Summary

Group	Description	Avg Load	Max Load	Fixture Qty
A	Football	41.0 kW	41.0 kW	68
B	Softball	20.84 kW	20.84 kW	36

Fixture Type Summary

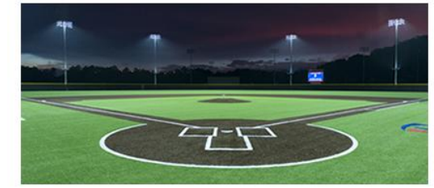
Type	Source	Wattage	Lumens	L90	L80	L70	Quantity
96 LED	LED 5700K - 75 CRI	400W	38,600	61,000	>72,000	>72,000	16
216 LED	LED 5700K - 75 CRI	630W	63,600	38,000	>60,000	>60,000	38
228 LED	LED 5700K - 75 CRI	630W	63,600	38,000	>60,000	>60,000	50

Light Level Summary

Calculation Grid Summary

Grid Name	Calculation Metric	Illumination				Groups	Fixture Qty
		Ave	Min	Max	Max/Min		
Football	Horizontal Illuminance	52.5	40	65	1.65	A	68
Grid	Horizontal	0.23	0	38	0.00	A,B	104
Softball (Infield)	Horizontal Illuminance	50.7	39	61	1.56	B	36
Softball (Outfield)	Horizontal Illuminance	30	18	43	2.31	B	36

From Hometown to Professional



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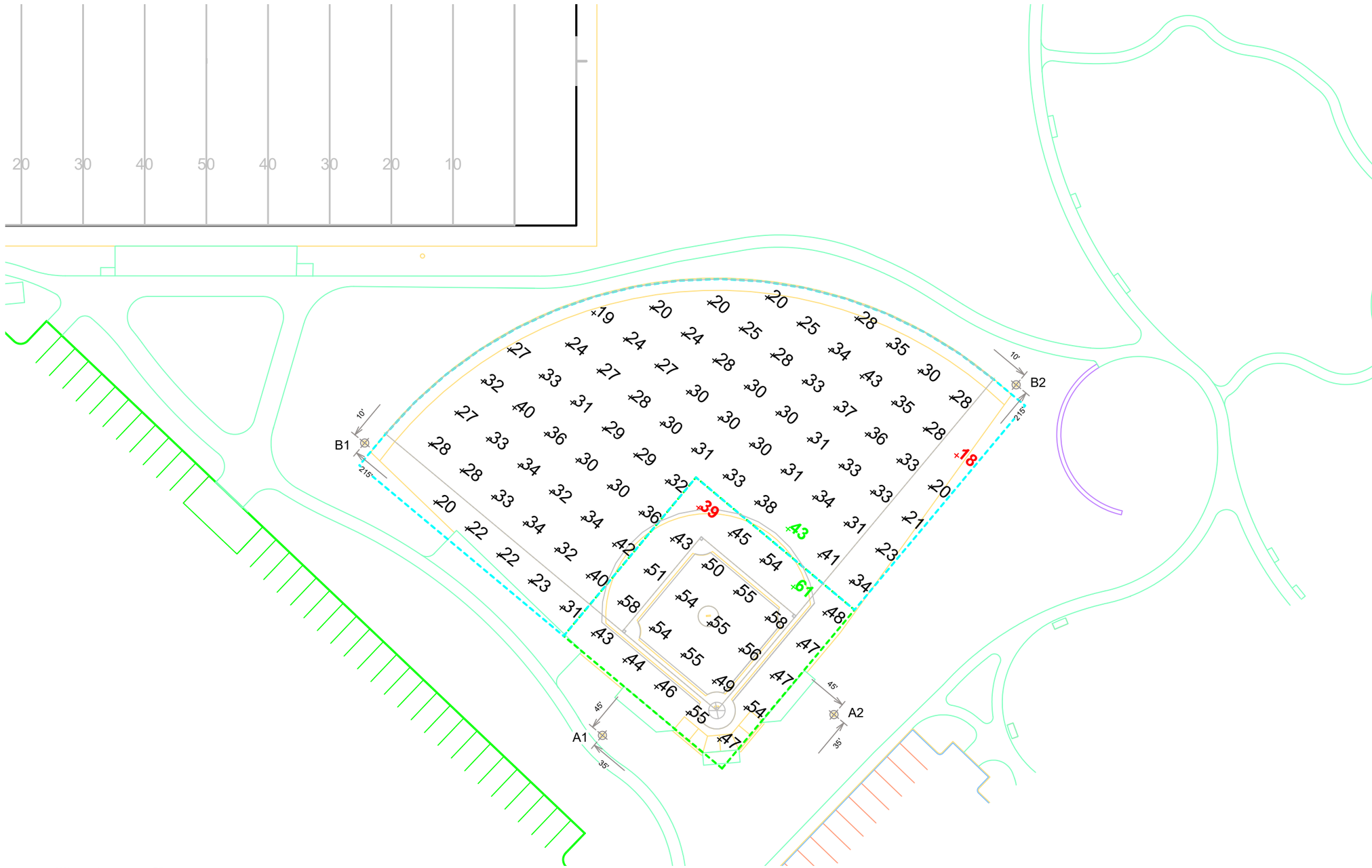
Newton Highland Playground

Newton,MA

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	A1-A2	60'	-	24'	96 LED	2	2	0
				60'	228 / 216 LED	6	6	0
2	B1-B2	70'	-	24'	96 LED	2	2	0
				70'	228 / 216 LED	8	8	0
4	TOTALS					36	36	0



GRID SUMMARY

Name:	**Softball**
Size:	210'/210'/210' - basepath 60'
Spacing:	20.0' x 20.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Infield	Outfield
Guaranteed Average:	**50**	**30**
Scan Average:	50.72	30.04
Maximum:	61	43
Minimum:	39	18
Avg / Min:	1.30	1.63
Guaranteed Max / Min:	**2**	**2.5**
Max / Min:	1.56	2.31
UG (adjacent pts):	1.35	1.61
CU:	0.68	
No. of Points:	25	77

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	63,600 / 63,600 / 38,600 lumens
No. of Luminaires:	**36**
Total Load:	20.84 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
216 LED	38,000	>60,000	>60,000
228 LED	38,000	>60,000	>60,000
96 LED	61,000	>72,000	>72,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

SCALE IN FEET 1 : 50

0' 50' 100'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

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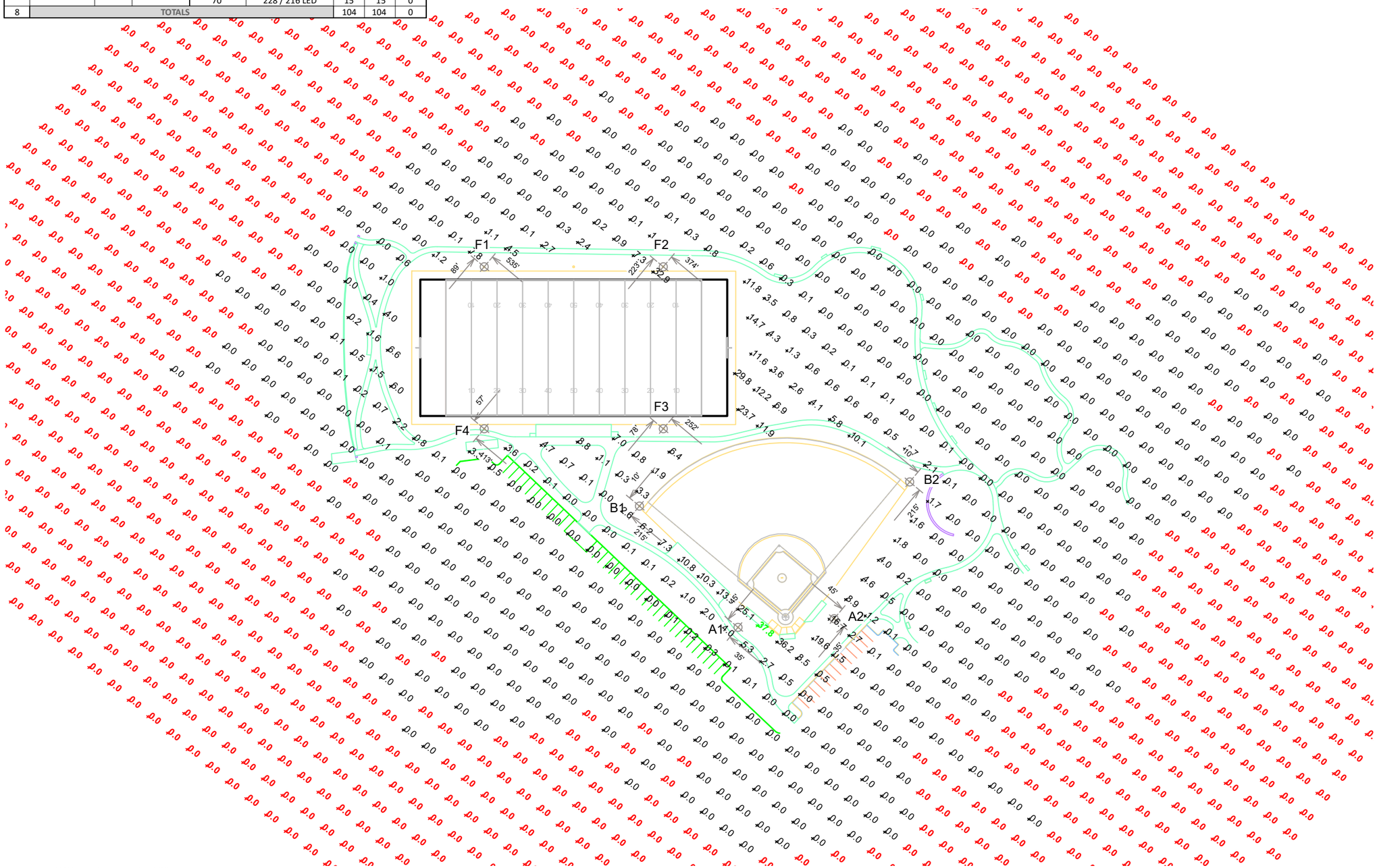
Newton Highland Playground

Newton,MA

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
2	A1-A2	60'	-	24'	96 LED	2	2	0
				60'	228 / 216 LED	6	6	0
2	B1-B2	70'	-	24'	96 LED	2	2	0
				70'	228 / 216 LED	8	8	0
4	F1-F4	70'	-	20'	96 LED	2	2	0
				70'	228 / 216 LED	15	15	0
8	TOTALS					104	104	0



GRID SUMMARY

Name:	**Grid**
Size:	210'/210'/210' - basepath 60'
Spacing:	30.0' x 30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**0.23**
Maximum:	38
Minimum:	0
Avg / Min:	-
Max / Min:	**-**
UG (adjacent pts):	660.71
CU:	0.08
No. of Points:	2374

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	38,600 / 63,600 / 63,600 lumens
No. of Luminaires:	**104**
Total Load:	61.84 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
96 LED	61,000	>72,000	>72,000
216 LED	38,000	>60,000	>60,000
228 LED	38,000	>60,000	>60,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the "**Musco Control System Summary**" for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

SCALE IN FEET 1 : 120

0' 120' 240'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

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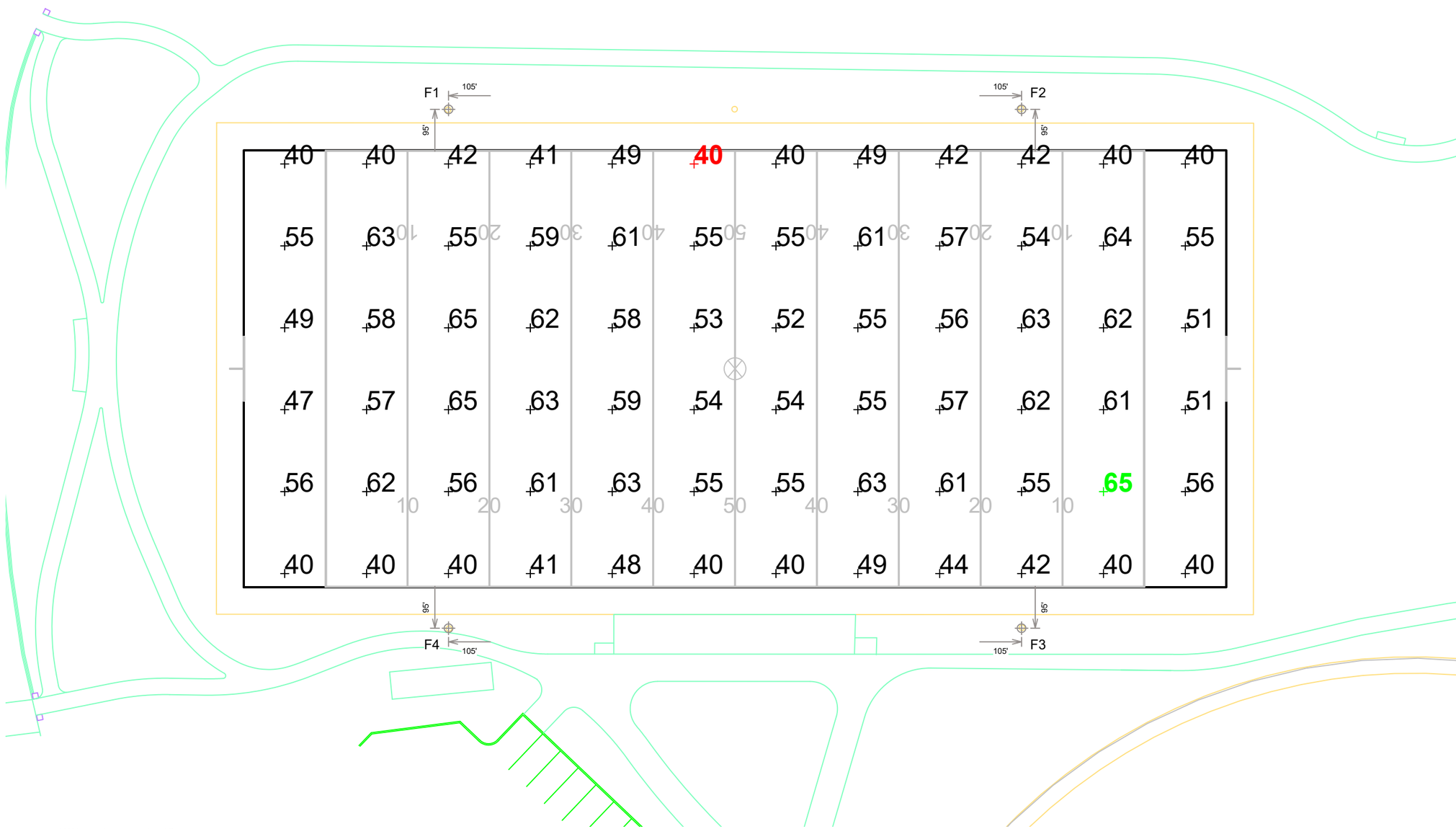
Newton Highland Playground

Newton,MA

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
4	F1-F4	70'	-	20'	96 LED	2	2	0
				70'	228 / 216 LED	15	15	0
4	TOTALS					68	68	0



GRID SUMMARY

Name:	**Football**
Size:	360.0' x 160.0'
Spacing:	30.0' x 30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Guaranteed Average:	**50**
Scan Average:	52.50
Maximum:	65
Minimum:	40
Avg / Min:	1.33
Guaranteed Max / Min:	**2**
Max / Min:	1.65
UG (adjacent pts):	1.63
No. of Points:	72

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	38,600 / 63,600 / 63,600 lumens
No. of Luminaires:	**68**
Total Load:	41.0 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
96 LED	61,000	>72,000	>72,000
216 LED	38,000	>60,000	>60,000
228 LED	38,000	>60,000	>60,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

SCALE IN FEET 1 : 40

0' 40' 80'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

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Newton Highland Playground

Newton,MA

EQUIPMENT LAYOUT

INCLUDES:
· Football
· Softball

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

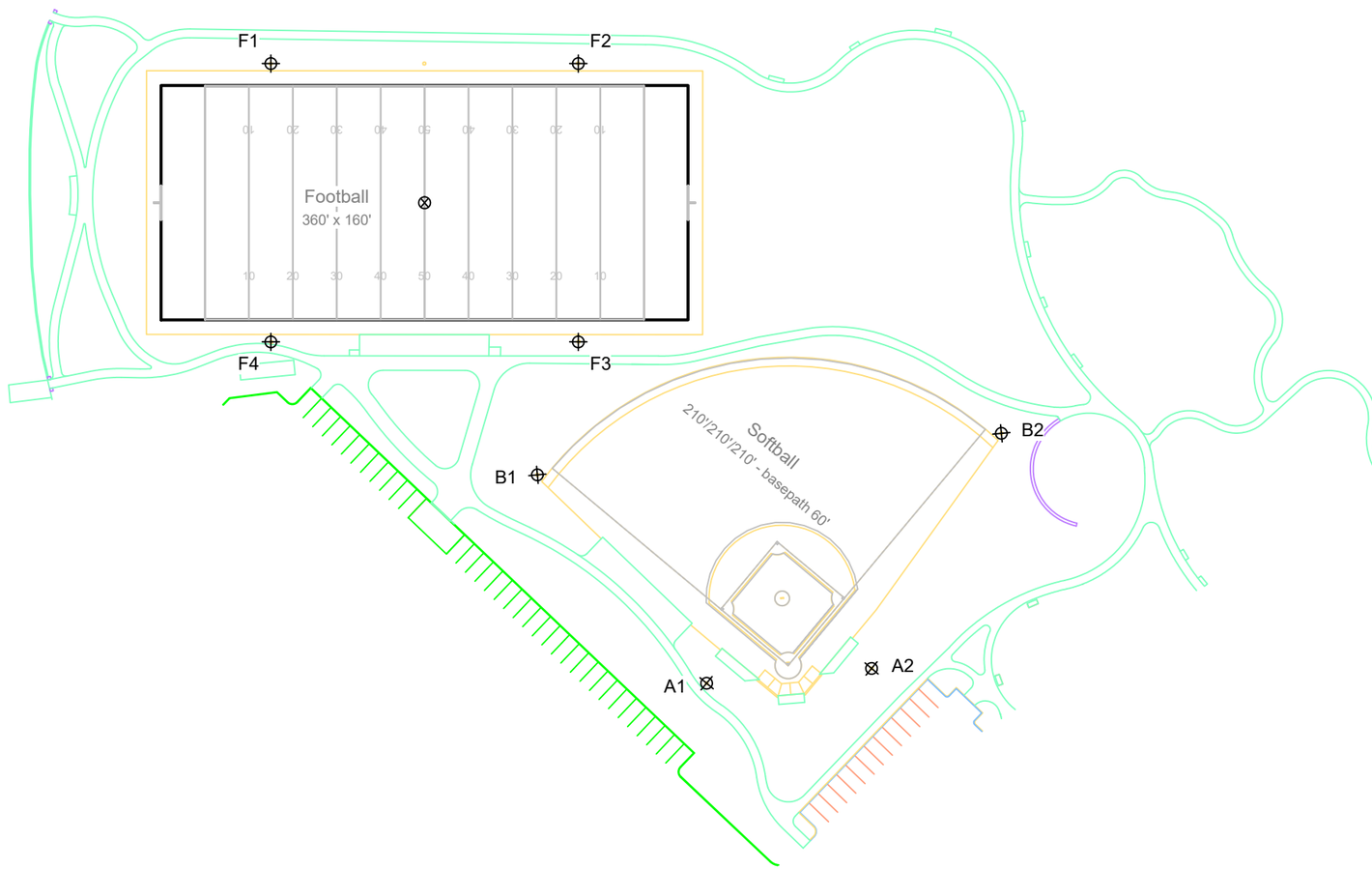
Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires		
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE
2	A1-A2	60'	-	24' 60'	96 LED 228 / 216 LED	2 6
2	B1-B2	70'	-	24' 70'	96 LED 228 / 216 LED	2 8
4	F1-F4	70'	-	20' 70'	96 LED 228 / 216 LED	2 15
8	TOTALS					104

SINGLE LUMINAIRE AMPERAGE DRAW CHART

Ballast Specifications (.90 min power factor)	Line Amperage Per Luminaire (max draw)						
Single Phase Voltage	208 (60)	220 (60)	240 (60)	277 (60)	347 (60)	380 (60)	480 (60)
96 LED	2.5	2.3	2.1	1.9	1.5	1.4	1.1
216 LED	3.9	3.7	3.4	3.0	2.4	2.2	1.7
228 LED	3.9	3.7	3.4	3.0	2.4	2.2	1.7



SCALE IN FEET 1 : 100
0' 100' 200'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

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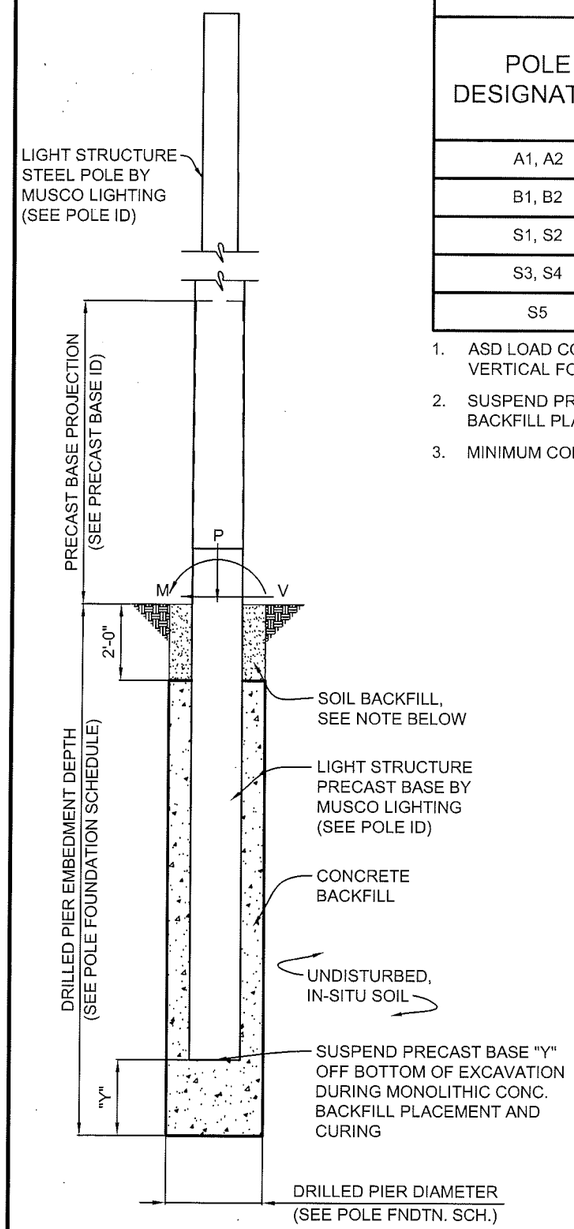

POLE FOUNDATION ELEV.

SCALE: NOT TO SCALE

SOIL BACKFILL NOTE:
THE TOP TWO FEET OF ANNULUS SHALL BE BACKFILLED WITH SOIL, WITH A CLASSIFICATION OF CLASS 5 (TABLE 1806.2) OR BETTER. COMPACTION, 95% FOR COHESIVE SOIL AND 98% FOR A COHESIONLESS SOIL BASED UPON STANDARD PROCTOR TESTING (ASTM D698).

POLE FOUNDATION SCHEDULE

POLE DESIGNATION	FORCES (1.)			DRILLED PIER			
	MOMENT (M) FT-LBS	SHEAR (V) LBS	VERTICAL (P) LBS	DIAMETER INCHES	EMBEDMENT DEPTH	SUSPENSION "Y" (2.)	CONCRETE BACKFILL YD^3 (3.)
A1, A2	46,716	1,256	1,367	36	15'-0"	3'-0"	3.1
B1, B2	80,540	1,826	2,007	36	17'-0"	3'-0"	3.4
S1, S2	45,939	1,243	1,367	36	15'-0"	3'-0"	3.1
S3, S4	55,221	1,399	1,547	36	15'-0"	3'-0"	3.1
S5	47,493	1,269	1,367	36	15'-0"	3'-0"	3.1

1. ASD LOAD COMBINATION D + W.
   VERTICAL FORCE IS WEIGHT OF DRESSED POLE (DOES NOT INCLUDE PRECAST BASE WEIGHT)
2. SUSPEND PRECAST BASE "Y" OFF THE BOTTOM OF THE EXCAVATION DURING MONOLITHIC CONCRETE BACKFILL PLACEMENT AND CURING.
3. MINIMUM CONCRETE BACKFILL VOLUME, SITE CONDITIONS MAY REQUIRE ADDITIONAL BACKFILL.

PRECAST BASE IDENTIFICATION

PRECAST BASE TYPE	PRECAST BASE WEIGHT	PRECAST BASE LENGTH	PROJECTION ABOVE GRADE	STANDARD EMBEDMENT	OUTSIDE DIAMETER
3B	2,470 LBS	20'-0"	8'-0"	12'-0"	13.38"
4B	3,490 LBS	22'-0"	8'-0"	14'-0"	15.75"

POLE IDENTIFICATION

POLE DESIGNATION	POLE TYPE	PRECAST BASE TYPE	FIXTURE CONFIGURATION (FIX. PER XARM)	FIXTURE AND ACCESSORIES EPA (FT^2)
A1, A2	LSS60B	3B	4 (4)	9.6
B1, B2	LSS70C	4B	5 (5)	13.5
S1, S2	LSS60B	3B	4 (4)	9.2
S3, S4	LSS60B	3B	6 (6)	13.2
S5	LSS60B	3B	4 (4)	10.0

DESIGN NOTES

DESIGN PARAMETERS:
WIND: 105 MPH (EXP. C, I = 1.0) PER IBC CODE, 2009 EDITION (ASCE 7-05).
DESIGN WIND PARAMETERS ARE AS NOTED. ACTUAL WIND SPEED AND EXPOSURE MUST BE VERIFIED FOR THE SITE BY THE PROPER GOVERNING OFFICIAL.

GEOTECHNICAL PARAMETERS:
ALLOWABLE END BEARING SOIL PRESSURE: 2,000 PSF
ALLOWABLE LATERAL SOIL BEARING PRESSURE: 0 PSF/FT (GRADE TO -2'-0");
49 PSF/FT (-2'-0" TO -4'-0"); 98 PSF/FT (BELOW -4'-0")
IN ACCORDANCE WITH THE 2009 EDITION OF THE INTERNATIONAL BUILDING CODE, CHAPTER 18.

DESIGN SOIL PARAMETERS ARE AS NOTED. ACTUAL ALLOWABLE SOIL PARAMETERS MUST BE VERIFIED ON SITE. REFERENCE SOILS AND FOUNDATION REPORT, NO. 2150258, PREPARED BY WESTON & SAMPSON; PEABODY, MA.

A GEOTECHNICAL ENGINEER OR REPRESENTATIVE OF IS RECOMMENDED (NOT REQUIRED) TO BE AVAILABLE AT THE TIME OF THE FOUNDATION INSTALLATION TO VERIFY THE SOIL DESIGN PARAMETERS AND TO PROVIDE ASSISTANCE IF ANY PROBLEMS ARISE IN FOUNDATION INSTALLATION.

ENCOUNTERING SOIL FORMATIONS THAT WILL REQUIRE SPECIAL DESIGN CONSIDERATIONS OR EXCAVATION PROCEDURES MAY OCCUR. POLE FOUNDATIONS WILL NEED TO BE ANALYZED ACCORDING TO THE SOIL CONDITIONS THAT EXIST. IF ANY DISCREPANCIES OR INCONSISTENCIES ARISE, NOTIFY THE ENGINEER OF SUCH DISCREPANCIES. FOUNDATIONS WILL THEN BE REVISED ACCORDINGLY. REVISIONS WILL BE ANALYZED PER RECOMMENDATIONS DIRECTED BY A REGISTERED ENGINEER.

ALL EXCAVATIONS MUST BE FREE OF LOOSE SOIL AND DEBRIS PRIOR TO FOUNDATION INSTALLATION AND CONCRETE BACKFILL PLACEMENT. TEMPORARY CASINGS OR DRILLERS SLURRY MAY BE USED TO STABILIZE THE EXCAVATION DURING INSTALLATION. CASINGS MUST BE REMOVED DURING CONCRETE BACKFILL PLACEMENT. CONCRETE BACKFILL MUST BE PLACED WITH A TREMIE WHEN SLURRY OR WATER IS PRESENT WITHIN THE EXCAVATION OR WHEN THE FREE DROP EXCEEDS 6'-0".

CONTRACTOR MUST BE FAMILIAR WITH THE COMPLETE SOIL INVESTIGATION REPORT AND BORINGS, AND CONTACT THE GEOTECHNICAL FIRM (IF NECESSARY) TO UNDERSTAND THE SOIL CONDITIONS AND THE POSSIBILITY OF GROUND WATER PUMPING AND EXCAVATION STABILIZATION OR BRACING DURING PRECAST BASE INSTALLATION AND PLACEMENT OF CONCRETE BACKFILL.

CONCRETE:
CONCRETE SHALL BE AIR-ENTRAINED AND HAVE A MINIMUM COMPRESSIVE DESIGN STRENGTH AT 28 DAYS OF 3,000 PSI. 3,000 PSI CONCRETE SPECIFIED FOR EARLY POLE ERECTION, ACTUAL REQUIRED MINIMUM ALLOWABLE CONCRETE STRENGTH IS 1,000 PSI. ALL PIERS AND CONCRETE BACKFILL MUST BEAR ON AND AGAINST FIRM UNDISTURBED SOIL.

GENERAL NOTES:
FIXTURES MUST BE LOCATED TO MAINTAIN 10'-0" MINIMUM HORIZONTAL CLEARANCE FROM ANY OBSTRUCTION. ENGINEER MUST BE NOTIFIED IF FOUNDATIONS ARE NEAR ANY RETAINING WALLS OR WITHIN / NEAR ANY SLOPES STEEPER THAN 3H : 1V. POLES, FIXTURES, PRECAST BASES, ELECTRICAL ITEMS AND INSTALLATION PER MUSCO LIGHTING.

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DRAWING TITLE: POLE AND FOUNDATION
SCALE: SEE PLAN
NOTES: SCAN #154869D

PROJECT NUMBER: 154869
DATE: 23 DECEMBER 2015
DRAWING NUMBER: C1
OF ONE

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