Lincoln Public Schools

Grades K - 8

Ballfield Road
Lincoln, Massachusetts

Schematic Design Project Manual
June 07, 2012

Submitted By

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Project No. 1101.00

DOCUMENT 000110

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OUTLINE SPECIFICATION

SCHEMATIC PHASE- CONSTRUCTION ASSEMBLIES AND SYSTEMS

PROJECT DESCRIPTION

10: GENERAL

1010 – Project Summary

- Project consists of demolition/selective demolition, renovations, and additions to an existing kindergarten through 8th grade school building, and associated site work in Lincoln, Massachusetts.
- Approximate new school building square footage: 53,000 gsf.
- Approximate existing school building square footage: 87,000 gsf.
- Site: Site work includes new parking areas, drives, walks, site utilities, and site improvements.
- Sequence: Addition, Renovation, Demolition/Selective Demolition, Site work completion.
- Sustainable Design: Project is pursuing MA-CHPS certification.

1020 – Project Program

- Kindergartens, Classrooms, Art rooms, Music Rooms, OP/TP, Computer rooms, Media Center, Multipurpose/Story, TV Studio, Literacy Specialist, Teacher Work-rooms, Resource rooms, Conference rooms, Foreign Language, Engineering, Auditorium, Lecture Hall, Speech, Band/Orch/Chorus rooms, Practice rooms, Gym 1, Gym 2, Gym 3, Locker rooms, Toilet rooms, Custodial, Circulation, Stor-age, Utility rooms, Cafeteria, Kitchen/Servery, Administration, Guidance, Nurse, and other rooms and spaces as shown on drawings.

1030 – Existing Conditions

- Refer to surveys, and existing building documents.

1040 – Owner's Work

- Owner will remove all existing furnishings and movable equipment prior to reno-vation and demolition.

1050 – Funding

- Local and State funding through MSBA.

20: PROPOSAL, BIDDING AND CONTRACTING

2010 – Delivery Method

- Construction Manager at Risk with Trade-Contractors as required by Massachusetts Public Bid Laws.

    - Anticipated Trade Bid categories:
        - MASONRY
        - MISCELLANEOUS AND ORNAMENTAL IRON
        - WATERPROOFING, DAMPPROOFING AND CAULKING
        - ROOFING AND FLASHING
        - GLASS AND GLAZING
        - TILE
        - ACOUSTICAL TILE
        - RESILIENT FLOORS
        - PAINTING
        - PLUMBING
        - HVAC
        - ELECTRICAL WORK

2020 – Qualification Requirements

- Bidders for General Construction and Trade-Bids shall be Pre-Qualified according to Massachusetts Public Bid Laws

- Bidders for General Construction and Trade-Bids shall be DCAM certified for their category of work.

2030 – Proposal Requirements: Not Applicable.

2040 – Bid Requirements

- Bidding procedures according to Massachusetts Public Bid Laws

- Separate bid package shall be issued for site/building utilities, concrete and steel.

2050 – Contracting Requirements

- Contracting procedures according to Massachusetts Public Bid Laws

<u>30: COST SUMMARY</u>

3010 – Elemental Cost Estimate: Refer to Schematic Design Cost Estimate.

3020 – Assumptions and Qualifications: Refer to Schematic Design Cost Estimate

3030 – Allowances: Not Applicable

3040 – Alternates:

- Alternate 1: Reed Gym equipment, including new backboards, scoreboards, bleachers, wall pads, and volleyball equipment.

- Alternate 2: Refinish Brooks Auditorium, including a new operable partition between Auditorium and Lecture Hall, new Auditorium and Lecture Hall seating, new carpet and paint, refurbishing the existing wood stage and side aisle floors, and new stage equipment.

- Alternate 3: Standing seam roof at 1994 Link building, in lieu of asphalt shingles.
- Alternate 4: Greenhouse Science Lab for the Environmental program.
- Alternate 5: Additional insulation at flat roofs to increase R-value from R32 to R42.
- Alternate 6: Add irrigation system at soccer and baseball fields.

3050 – Unit Prices: Not Yet Determined

A. SUBSTRUCTURE

A10: FOUNDATIONS

See attached structural narrative, and preliminary foundation engineering and geotechnical report.

B. SHELL

B10: SUPERSTRUCTURE

See attached structural narrative.

B20: EXTERIOR ENCLOSURE

B2010 – Exterior Walls

- Exterior facing, typical: Combination of brick, ground-face CMU, precast concrete copings, standing and flat seam sheet metal siding, and composite metal siding.
  - Multiple colors and patterns in masonry and metal wall panels will be required.
  - Existing Reed Gymnasium upper exterior precast panels shall be removed and replaced with new exterior facing.
  - Selective portions of existing buildings shall be resided.
- Thermal and moisture protections: Combination of 2 inch continuous extruded polystyrene insulation and R-19 fiberglass batt insulation in stud cavity, and fluid-applied air/vapor permeable barrier. Assembly must be tested to NFPA.
  - Spray-foam insulation shall be used for existing exterior walls.
- Back-up wall: Combination of cold-formed metal framing and CMU.
- Exterior graphic aluminum building signage with tube steel support systems.

B2020 – Exterior Windows and Louvers

- Window replacement at the 1963 and 1971 buildings.

- Operable vents (zero-sightline) within curtain wall framing.
- 1" thick double glazed insulating glass unit assembly, argon filled air space and solar control low-e coating on two surfaces.
- Aluminum storm-proof louvers finished to match curtain wall.
- Storefront system at clerestories and connecting corridors.

B2030 – Exterior Doors

- Stile-and-rail aluminum doors with aluminum frames, typical.
- Galvanized, painted, and insulated steel doors and frames, where indicated.
- Electrically operated galvanized and insulated sectional doors for service areas.

B2040 – Curtain Wall

- 6-inch deep framing, field glazed with insulating glass assemblies as for exterior windows. Operable vents (zero-sightline) within curtain wall framing.
  - 2 metallic colors shall be used, one for framing and one for sashes.
- Integral horizontal and vertical sunshades and light shelves on the east, west, and south sides of building.

B30: ROOFING

B3010 – Roof Coverings:

- All existing roofs and sheet metal trim/flashings (except for Reed Gym) shall be removed and replaced with new roofing.
- PVC membrane roofing, typical: Fully adhered PVC roofing with extruded poly-styrene insulation, ½-inch gypsum protection board with glass mat facing and 6-mil reinforced vapor barrier. PVC membrane roofing shall be white or light grey.
- Walkway pads for service on roof.
- Roof accessories: Scuppers, roof edge, copings, gutters and downspouts, and flashings; and internal drains.
- Soffits: A combination of composite metal panels, sheet metal siding, and direct-applied finish system (DAFS).

B3020 – Roof Openings:

- Skylights: Plastic unit skylights for new locations and to replace existing.

C. INTERIORS

C10: INTERIOR CONSTRUCTION

C1010 – Partitions

- Abuse and impact resistant gypsum wallboard on steel studs.
- Patching of existing gypsum wallboard surfaces.
- High-impact gypsum wallboard on plywood backer at indicated locations.
- Center-scored, reinforced CMU: Normal-weight.

C1020 – Interior Doors

- Welded metal frames, typical: Formed steel
- Replacement of existing interior doors and frames as required.
- Wood doors, typical: Flush doors with factory-finished oak veneer and custom vision panels.
- Door Hardware.
- Sound gasketed doors for: Auditorium, Lecture, Practice Rooms, and Music rooms.
- Electrically and manually operated overhead coiling doors, counter and full height.

C1030 – Fittings Specialties

- Acoustic wall panels in Music Rooms, Practice, and as indicated.
- Utility and closet shelving.
- Toilet Accessories.
- Fixed markerboard and tackboards.
- Interior signage including acrylic room signs, stainless steel etched plaques, building directory and dedication plaque.
- Solid plastic (HDPE) toilet and shower/changing area partitions, ceiling supported.
- Cubicle curtains and tracks for Nurse Exam room.
- Plastic student, staff, and athletic lockers. Student lockers shall be double-tier, and athletic lockers shall be multi-tier compartments.
- Fire protection specialties.
- Loading dock bumpers.
- Emergency key box for fire department.

- Corner guards.
- OT/PT, and miscellaneous metal supports and framing.

C20: STAIRS

C2010 – Stair Construction

- Cast-in metal stair nosing and metal railings for exterior concrete stairs.
- Metal stair at loading dock (interior).

C30: INTERIOR FINISHES

C3010 – Wall Finishes

- Refinishing all wall surfaces.
- Water-based latex system, typical: Primer with two finish coats
- High-performance system for corridors, stairways, toilet rooms, and Kitchen: Epoxy primer with two polyurethane finish coats
- Glazed ceramic tile for toilet rooms, thin-set.
- Acoustic reflector and absorptive panels in Music area.

C3020 – Floor Finishes

- Replacement of all existing flooring finishes.
- Bio-based composite flooring, typical classroom locations.
- Linoleum sheet flooring, typical locations except for classrooms.
- Carpet tile for offices and broadloom for Auditorium (Alternate): CRI Green Label carpet, adhered to concrete (as indicated in room data sheets).
- Ceramic tile for toilet rooms: 2” square unglazed porcelain tile, thin-set.
- Porcelain tile, 12” x 12” in Lobby.
- 2-stage entry mat system at vestibules: Recessed entrance mats with carpet inserts, and surface mounted entrance mats.
- Epoxy resinous flooring in Kitchen, Locker Rooms, and Custodial Closets.
- Synthetic sports flooring, sheet goods for gym.

C3030 – Ceiling Finishes

- Replacement of all existing ceilings.
- 2x2 acoustical ceiling tile (suspended and applied), typical.

- Exposed painted steel structure and deck.
- Drywall soffits.
- Acoustic reflector and absorptive panels in Music area.
- Moisture resistant, clean room type ACT for Kitchen.

D. SERVICES

D20: PLUMBING

See attached narrative and outline.

D30 HEATING, VENTILATING AND AIR CONDITIONING

See attached narrative and outline.

D40: FIRE PROTECTION SYSTEMS

See attached narrative and outline.

D50 ELECTRICAL SYSTEMS

See attached narrative and outline.

E. EQUIPMENT AND FURNISHINGS

E10: EQUIPMENT

E1010 – Commercial Equipment

- Commercial food service equipment for Kitchen. See attached narrative and outline.

E1090 – Other Equipment

- Athletic equipment including: Basketball backstops, scoreboard and shot clocks, wall pads, and volleyball standards.
- Panoramic curtain for TV Studio.
- Hydraulic loading dock leveler.
- Residential appliances including: refrigerators, microwave ovens, dishwashers, lab dishwashers, and electric ranges.
- Folding electrically operable panel partition between Lecture Hall and Auditorium.

E20: FURNISHINGS

E2010 – Fixed Furnishings

- Custom transparent finish oak millwork including classroom casework with plastic laminate countertops and metal grilles, teacher work stations, display cases with glass shelves, mailbox cubbies, bookcases, wood benches, and Admin./Other desks.

- Modifications to existing casework and millwork.

- Manually operated window shades, including blackout shades where indicated.

- Vertical louver blinds.

- Fixed lecture seating with tablet arms in Lecture Hall.

- Telescoping bleachers in Gymnasium.

F. SPECIAL CONSTRUCTION AND DEMOLITION

F20: DEMOLITION

F2010 – Building and Site Elements Demolition

- Selective demolition.

- Removal of existing building, foundations, and site improvements.

- Salvaging items as indicated, including existing circulation desk.

F2020 – Hazardous Components Abatement

- Refer to hazardous materials report.

G. BUILDING SITEWORK

G10: SITE PREPARATION

G1030 – Site Earthwork

G20: SITE IMPROVEMENTS

See attached narrative.

G30: SITE CIVIL/MECHANICAL UTILITIES

See attached narrative.

G40: SITE ELECTRICAL UTILITIES

See attached narrative.

Z. GENERAL REQUIREMENTS

Z1010 – Administration

Z1020 – Procedural General Requirements and Quality Requirements

Z1030 – Temporary Facilities and Temporary Controls

Z1040 – Project Closeout

Z1050 – Permits, Insurance and Bonds

Z1060 – Fees

Z2010 – Bidding Requirements Design Contingency

End of Document

Crabtree McGrath
Associates, Inc.

Foodservice Narrative

Crabtree McGrath Associates, Inc., a consulting group specializing in foodservice facilities planning and design, has been retained by OMR Architects of West Acton, Massachusetts to provide foodservice design for the new consolidated kitchen to serve students in grades K thru 8.

In meeting with the Foodservice staff, the design team reviewed the current conditions and identified program items that would be part of the foodservice operation. For example, the program today operates with disposable ware. The goal is to move to a compartmented reusable tray. Many other requests made by the kitchen staff were baseline equipment items needed to efficiently operate a modern foodservice operation.

Kitchen and Food Preparation Area

The kitchen facility shall include all the necessary components of a functional kitchen to include: a receiving area to be used as a staging point for the breakdown and distribution of delivered goods; refrigerated rooms for storage of refrigerated and frozen products are to be offered and sized to accommodate the needs of the facility; and dry goods storage for the keeping of canned, boxed, and other non-refrigerated food items. Food grade storage shelving and dunnage platforms shall be provided for dry goods storage and for storage of disposable items like plastic utensils, serving trays, and other paper related items.

Food preparation shall take place on stainless steel tables of various sizes and configurations. Tables may be fashioned with sinks, drawers, shelves, and overhead pot storage hook racks. Motorized food preparation equipment such as a food slicer, food cutter, and mixer shall be provided. Sizing of this equipment will be based on the scope of food preparation and tailored to fit the designed operation.

Cooking shall take place in a common location adjacent to both food storage and preparation. Equipment shall consist of standard pieces such as convection ovens, cooking kettles, braising pans, steamers, and open burner range tops. Adjustments shall be made to cooking equipment to suite the specific desired menu. The facility will include the necessary ware washing equipment to process ware, pots, trays, and pans.

Other support facilities located in or adjacent to the kitchen will include a staff toilet for men and women, a dedicated kitchen slop sink with enough space for the storage of mops, buckets and detergents. A clothes washer and dryer will be provided for the washing of mop heads, aprons, and kitchen hand towels. Typically grouped with this equipment are employee locker accommodations for the storage of personal items such as coats, handbags, or shoes.

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Serving Area

Serving will take place in three separate lines on various counters, organized into linear configurations, allowing for orderly and secure serving of food products. Counters are grouped into multiple hot food serving lines that will serve the typical school lunch. These lines shall include the necessary equipment needed to provide cold side offerings such as fruit, salads, and beverages.

Other serving lines sometimes consist of an alternate hot food line with the ability to serve hot sandwiches, burgers, pizza, and any other alternate hot food items.

Each of the lines will funnel into a common area large enough to accommodate the flow of traffic where the transaction is to take place. Mobile counters with tray slides will be provided to accept "Point of Sale" terminals, where students can pay with cash, or type in a code that is linked to a declining balance pre-paid system.

Serving line configurations will include a separation of cold and hot items as well as a separation of grade levels. Due to varying tray slide heights and menu needs, the K-4 students shall be served in a dedicated line. The 5th-8th grade level shall be served on the remaining two lines, allowing for more choices and higher level of service. The middle grades menu is typically more complex and offers greater variety. In each instance, an adequate amount of mechanical cold pans and appropriate hot holding equipment is needed.

SCHEMATIC OUTLINE SPECIFICATIONS

STRUCTURAL – GENERAL (Refer to Schematic Design Structural Drawings)

The proposed, one-story addition will be constructed on a relatively flat site and divided into two distinct areas. One area will be located between the existing 1963 Auditorium and 1970 Reed Field House, and the other will be situated to the south of the existing 1963, 1970, and 1994 Buildings to remain. Program elements of the new addition to the north include the Gymnasium, the Cafeteria, the Kitchen, Faculty Dining, and Receiving/Storage (all in Part B). Program elements of the new addition to the south include elementary classroom and administrative areas (all in Part C). The new additions will be connected to each other and to the existing construction with new one-story corridors. The total area of new construction is approximately 53,000 square feet.

The 1963, 1970, and 1994 Buildings (Brooks School), which comprise a total of 86,000 square feet in area, will be renovated and remain in service. A small storage area to the north of the Reed Field House, constructed in 2007, and approximately 900 square feet in area, will also remain in service. Program elements in the renovated wings will include middle school classrooms, the Media Center, the Auditorium, music rooms, gymnasiums, and locker rooms.

The original 1948 elementary school building and the 1951, 1954 and 1994 Kindergarten classroom additions (Smith School) will be demolished and removed from the site.

The new addition will be steel framed, for reasons of economy, performance, flexibility and speed of construction. The roof will be steel framed, with steel roof deck supported by open web steel joists, wide flange steel beams and columns (no concrete slab). Long span steel joists will be used at the Gymnasium to economically achieve the long span, column free spaces, while closely matching the existing framing in the Reed Field House. Typical columns will be rectangular hollow steel tube sections. Lateral stability for wind and seismic loads will be provided by steel bracing in each direction. Roof steel framing will be surface prepped and be shop primed.

Foundations are expected to be conventional shallow spread footing construction (per the *Preliminary Geotechnical Recommendations of* August 3, 2011 prepared by Nobis Engineering, Inc.), with concrete slabs on grade at the First Floor. It is assumed that existing utilities within the footprint of the addition will be removed and relocated to accommodate the new construction. It is not expected that rock will be encountered in the general building excavation.

Exterior wall construction will be a mixture of glazing and steel stud cavity wall construction with a brick/stone veneer. Continuous, steel channels will be provided at the heads of continuous glass transoms, and a steel girt/sill/wind column system will be provided to frame out large window openings.

STRUCTURAL - BASIS OF DESIGN

Codes and Design Standards:

Building Code:	Massachusetts State Building Code (780 CMR) - Eighth Edition.
Structural Steel:	AISC “Specification for Structural Steel Buildings” and AISC “Code of Standard Practice”; latest editions.
Concrete:	ACI 318 and ACI 301; latest editions.

Design Loads/Parameters:

Live Loads

Classrooms (with partition allowance):	80 PSF
Corridors and Open Plan Areas:	100 PSF
Stairs:	100 PSF
Mechanical Areas:	150 PSF

Snow Loads

Basic Ground Snow Load (Lincoln):	55 PSF

Wind Loads

Wind Speed (Lincoln):	100 MPH

Seismic Parameters

Short Period Spectral Response Acceleration(S_s):	0.280
1.0 Sec. Spectral Response Acceleration (S_1):	0.069
Seismic Use Group:	II
Seismic Design Category:	B
Site Class:	D (Preliminary)
Structural System:	Building Frame System
Lateral Load Resisting System:	Concentrically Braced Frames (*Not Specifically Detailed for Seismic Resistance)*
Response Modification Factor (R):	3.0
System Overstrength Factor (Ω_0):	3.0
Deflection Amplification Factor (Cd):	3.0

Foundations:

The preliminary foundation design is based on an allowable bearing capacity of 4.0 kips per square foot (2.0 TSF) on natural soils or on compacted structural fill, per the *Preliminary Geotechnical Recommendations of* August 3, 2011 prepared by Nobis Engineering, Inc.

Construction Classification:

The new addition is expected to be classified as Type 2B Construction (Noncombustible, Unprotected). All new steel framed construction is considered to be *restrained.*

Sustainable Design Considerations:

Sustainable design considerations will be incorporated into the building design; it is intended that the project will comply with the provisions of the 2009 Collaborative for High Performance Schools, *Massachusetts High Performance Green School Guidelines.* No green roof areas are proposed.

GROUP A – SUBSTRUCTURE (Refer to Schematic Design Structural Drawings)

A10 Foundations:

Preliminary borings indicate that subsurface soils vary throughout the site. The eastern portion of the site is underlain by soft to stiff silt/clay/sand deposits with organics, approximately 5 to 7.5 feet thick, and excavation of this material is required, followed by backfill of suitable compacted structural fill. The western portion of the site does not include such organics, and it is recommend that the building be supported by shallow spread footings bearing on the native inorganic sand, sand and gravel, or on Gravel Fill placed above these materials. The northern portion of the site, between the existing auditorium and gymnasium, is underlain by medium dense sand and gravel fill, approximately 9 feet thick. There is also an underground storage tank at this area.

It is assumed that the underground utilities and storage tank will be removed prior to construction. It is recommended that any fill at the northern portion of the site that is not removed during excavation of existing utilities be densified by intensive Surface Compaction. Also, the existing Boiler Room addition (and foundations) at the1963 Auditorium will be demolished, and this area will be backfilled with compacted structural fill.

All foundation walls and footings will be cast-in-place, reinforced concrete. The preliminary foundation design is based on an allowable bearing capacity of 4.0 kips per square foot (2.0 TSF) on natural soils or on compacted structural fill, per the *Preliminary Geotechnical Recommendations of* August 3, 2011 prepared by Nobis Engineering, Inc.

Groundwater was encountered at 5 to 9 feet below the ground surface. Foundation and/or underslab drainage systems will not generally be required, as there are no basement areas. However, dewatering during construction may be needed, as recommended in the *Preliminary Geotechnical Recommendations.*

Refer to the *Preliminary Geotechnical Recommendations* for additional information regarding site conditions, site preparation, foundation construction and drainage issues.

A1010 Standard Foundations:

- Typical perimeter frost wall: *14" thick, with an 8" wide masonry shelf with horizontal and vertical reinforcing each face (4.0+/- psf). The outside surface of perimeter foundation walls should receive a trowelled-on bituminous mastic.*

- Typical perimeter frost wall continuous footing: *2'-0" wide, by 12" deep, with continuous reinforcing bars, plus dowels to the foundation wall (10.0+/- plf). The bottom of the footing will be placed 4'- 0" minimum below the exterior finish grade for frost protection.*

- Typical, average interior column footings: *5'-0" x 5'-0" x 1'-6" deep, with 165 pounds of reinforcing. The bottom of the footing will be approximately 2'-6" below the First Floor slab on grade.*

- Typical, average perimeter column footings: *4'-0" x 4'-0" x 1'-6" deep, with 100 pounds of reinforcing. The bottom of the footing will be approximately 4'-6" below the exterior finish grade.*

- Piers/pilasters at interior/perimeter columns: *22 inches square, reinforced concrete with 35 plf reinforcing.*

- Anchor Rods: Anchor rods at column base plates shall conform to ASTM F1554 – Grade 36 and shall be headed type. Provide a minimum of four (4), ¾" diameter anchor bolts at all columns; additional rods and/or larger diameter will be required at bracing locations.

A1020 Special Foundations:

- Additional special foundation work will be required at the 1994 Link Building (e.g. underpinning of existing slabs/foundations along the western edge to frost depth, etc.), as described later in this Specification.

A1030 Slabs on Grade:

First Floor Construction will typically be a 5" thick concrete slab on grade, reinforced with welded wire fabric. The slab will be underlain by a vapor barrier, rigid insulation and 6" of compacted gravel fill. Buried duct work will be placed below the new slab on grade; refer to the Schematic Design Mechanical Drawings for additional information. Saw cut control joints (1.25" deep) will be provided in each direction on each column line. Full depth isolation joints will be constructed around columns

- Welded wire fabric for slabs on grade: *6x6-W2.9xW2.9.*

- Slab on Grade Thermal Insulation: *R=5 extruded polystyrene foamed plastic board.*

- Slab On Grade Vapor Retarder: *ASTM E1745 Standard for Specification for Water Vapor Retarders Used In Contact With Soil or Granular Fill Under Concrete Slabs; Class A.*

GROUP B – SHELL (Refer to Schematic Design Structural Drawings)

B10 Superstructure:

Structural Bays/Spans: At the Classroom Wing (Part C), a 6'-0" x 4'-0" module has been established. The typical structural bay size is 30'-0" x 28'-0", with intermediate columns at the 12 foot and 18 foot (east-west) locations, as required for lateral bracing. Classrooms are generally 28'-0" x 30'-0". Interior columns will be located on both sides of the east-west corridor and along the breakout/resource rooms (at braced frames). In Part B, the Gymnasium roof has a clear span of approximately 75 feet, and bay sizes vary in the Cafeteria, Storage, and Faculty Dining areas. Refer to the Schematic Design Structural Drawings for additional information.

Story Heights: The preliminary story height for roof level of the Classroom Wing (Part C) has been established at 10'-6", with a clerestory roof height of 17'-2" along the corridor. At Part B, roof elevations vary at the Gymnasium, the Cafeteria/Kitchen/Storage/Faculty. Refer to the Schematic Design Architectural Drawings for additional information.

Steel Framing Connections: Type 2 simple framing connections (shear only); double clip angles typically.

Columns: Typical columns will be rectangular steel tube (HSS) sections.

Lateral Force Resisting System: Lateral (wind and seismic) forces will be resisted by steel bracing, for reasons of economy, stiffness, reduced structural depth and smaller column sizes. Bracing members will be square or rectangular HSS sections. Brace configurations may include chevrons, inverted chevrons ("V"), or single diagonals in short bays, as required by architectural considerations. At the new corridors, lateral load resistance will be resisted by steel moment frames.

Expansion (Seismic) Joints: North-south expansion joints will be provided within Part C and between the areas of new and existing construction.

Fire Protection: Fire walls will be provided between all new and existing construction so that the existing buildings can retain their current Construction Type classifications. All new construction will be fully sprinklered and classified as Type 2B Construction (Noncombustible, Unprotected). All new steel framed construction is considered to be *restrained.* Refer to the Schematic Design Architectural Drawings for additional information.

B1020 Roof Construction:

At the Classroom Wing (Part C), steel roof deck will be the cellular acoustic type (3" deep, 20/20 gauge). Above classrooms, the deck will span to exposed, open web steel roof joists at 5'-0" o.c., and above administrative areas, the deck will span to steel beams at 5'-0" +/- o.c. The clerestory roof framing (over the corridor) will be of the same construction as the roof framing over the classrooms. At both areas, steel beams are typically supported by wide flange steel girders and steel tube columns (HSS).

At the Gymnasium (Part B), steel roof deck will be the cellular acoustic type (3" deep, 20/20 gauge) spanning to, deep longspan, open web steel joists (3'-4" deep), with pitched top chords, spaced at 10'-0" +/- o.c. and clear spanning the space (75 feet +/-). At the remainder of Part B, flat roof construction will consist of a 1½" deep, Type WR, 18 gauge galvanized steel roof deck spanning 6 feet (maximum) to open web steel joists and wide flange steel beams. Steel beams are typically supported by wide flange steel girders and steel tube columns (HSS).

Structural steel for the corridor and cafeteria columns will be Architecturally Exposed Structural Steel (A.E.S.S.).

Roof drainage will typically be achieved with tapered insulation. Continuous, bent steel plates will be installed around the entire roof perimeter to support the roof edge and blocking.

Rooftop mechanical units (with manufacturer's standard curbs) will be supported directly on the roof structure. Steel framed equipment screens will be provided around selected units. Roofing will be a lightweight, adhered membrane system. Refer to the Schematic Design Architectural and Mechanical Drawings for more information.

Estimated weight of steel:

- The estimated total weight of structural steel for the various roof areas of the new building (based on 53,000 +/- gross square feet of total new framed roof area), including beams, columns, bracing, plates, angles, sills, girts, wind posts/headers, miscellaneous frames, connections, etc., but excluding entry canopies is ***310 +/- Tons.***

- The estimated weight of steel joists and accessories is ***50 +/- Tons.***

B20 Exterior Enclosure:

B2010 Exterior Walls:

Exterior walls for new addition will be a mixture of glazing and steel stud/brick veneer cavity wall construction. Continuous steel channels will be provided at the heads of continuous and/or long windows below the roof.

Vertical steel tubes (approximately 2'-4" high), spaced at 6'-0" o.c. and integrated with the steel stud backup wall, will be bolted to the perimeter frost wall at the First Floor to laterally support the stone veneer below the continuous windows.

The steel stud backup will be 16 gauge minimum, designed for an H/600 deflection limitation. Vertical slip joints will be provided in the metal stud backup system at each level. A sunscreen element, integrated with the window system, will be provided at the south-facing exterior walls of the new building.

STRUCTURAL - SCOPE OF WORK AT EXISTING BUILDINGS

The 1963, 1970 and 1994 Buildings, which comprise approximately 86,000 square feet in area, will be renovated and remain in service. Program elements in the renovated buildings will include middle school classrooms, the Media Center, the Auditorium, music rooms, gymnasiums, and locker rooms.

Renovations, alterations, repairs and additions to existing buildings in Massachusetts are governed by the provisions of the Massachusetts State Building Code (MSBC – 8th Edition) and the Massachusetts Existing Building Code (MEBC). These documents are based on amended versions of the 2009 *International Building Code (IBC)* and the 2009 *International Existing Building Code (IEBC)*, respectively.

The MEBC defines three (3) compliance methods for the repair, alteration, change of occupancy, addition or relocation of an existing building. The three methods are *Prescriptive Compliance Method, Work Area Compliance Method,* and *Performance Compliance Method*. The method of compliance is chosen by the Design Team (based on the project scope and cost considerations) and cannot be combined with other methods.

A review of the proposed renovation scope suggests that the *Prescriptive Compliance Method* can be selected by the Design Team. This assumption will continue to be evaluated as the project proceeds through future design phases.

The *Prescriptive Compliance Method* (IEBC Chapter 3) duplicates Sections 3403 through 3411 of Chapter 34 in the IBC and prescribes specific minimum requirements for construction related to additions, alterations, repairs, fire escapes, glass replacement, change of occupancy, historic buildings, moved buildings and accessibility. A complete structural evaluation of the building is not required, if the impact of the proposed alterations and additions to structural elements carrying gravity loads and lateral loads is minimal (less than 5% and 10% respectively). Seismic upgrades to the existing building are generally not required. An exception is buildings with unreinforced masonry (URM) bearing walls (as in this project). Buildings with unreinforced masonry bearing walls are required to be evaluated with respect to the provisions of Appendix A1 of the IEBC (applies to all compliance methods).

Under this compliance method, a comprehensive structural review of the primary structural systems (gravity and lateral loads) is not required, except as necessary to ascertain the effect of the proposed work on the existing building structure. Full compliance with the seismic provisions of the code for new construction will not be necessary. However, as the renovations to the building will exceed 50% of the area, the existing unreinforced masonry (URM) walls in the building will need to be evaluated for compliance with the provisions of Appendix A1 of the 2009 IEBC (Section 101.10 of the Massachusetts Amendments to the 2009 IEBC). Essentially, this means the following:

- A lateral load analysis of the building will be required to demonstrate that capacity exists to withstand 50% of the seismic forces required by the code for new construction.

- Interior, non-structural masonry partitions, scheduled to remain will need to be braced at the top.

- Floor and roof diaphragm capacity and anchorage to the masonry walls will need to be evaluated.

The new addition will be structurally separated from the existing buildings by expansion (seismic) joints to avoid an increase in gravity load or lateral loads to existing structural elements (Sections 302.3 and 302.4 of the 2009 IEBC, respectively). Where proposed alterations to existing structural elements carrying gravity loads result in an increase of over 5%, the affected element will be reinforced or replaced to comply with the code for new construction (Section 303.3). Proposed alterations to existing structural elements carrying lateral load which result in an increase in the demand - capacity ratio of over 10% will generally be avoided (Section 303.4).

The anticipated scope of structural alterations to the existing buildings is noted below:

- At the 1970 Reed Field House, new supports for HVAC equipment will be required, as well as minor modifications to existing structural elements to accommodate MEP/FP distribution systems. *The preliminary cost estimate should include a line item to cover this work.* See Schematic Design Mechanical and Architectural Drawings for additional information.

- A portion of the western edge of the 1994 Building adjoins the original (1948) building. As this area is presently an interior condition, the edge of the slab on grade terminates with a downturned, concrete haunch or a grade beam (bottom at 2'-0" +/- below the top of slab). Upon demolition of the adjacent, 1948 construction, this section will become exterior and will be exposed to cold temperatures (frost concerns). Accordingly, underpinning of the existing slab/foundations to frost depth or the construction of a new foundation wall with 4'-0" minimum soil cover to the bottom of the footing will be required (approximately 80 linear feet total). New exterior wall construction in these areas (brick veneer with a steel stud backup) will be supported on the modified existing foundations and/or the new foundation walls. Since the 1994 Building is not perpendicular to the 1948 Building, a new, triangular shaped area of slab will be required to create a straight edge on the remaining 1994 Building. *The preliminary cost estimate should include a line item for this work.*

- The roof decks of the 1963 and 1970 buildings (except for the high field house roof) are constructed of 2" tongue and groove roof decking. This type of decking does meet the diaphragm requirements of Appendix A1 of the 2009 IEBC, and it will need to reinforced with a new, plywood diaphragm. *The preliminary cost estimate should include a line item for a layer of ¾" plywood, screwed and glued to existing decking at these locations*.

- The new addition between the auditorium and the Reed Field House will create a snow drift condition at the eastern edge of the adjacent low roof (of 106 psf, in addition to the flat snow load of 42 psf). In addition, the presence of the high (auditorium roof) creates a snow drift condition (of 80 psf max, in addition to the flat snow load 42 psf) on the other three sides of the low roof (the original design snow load was 40 psf total). As a result of this loading, the existing low roof framing on the east and west sides does not have sufficient capacity for this loading and will need to be reinforced or rebuilt to sustain the higher loading. *The preliminary cost estimate should include a line item for 5,000 square feet of existing wood joist and steel beam roof reinforcement or reconstruction.* Also, at the north and south sides of the Auditorium, the existing wood decking at the low roof, adjacent to the Auditorium walls, needs to be reinforced with a layer of steel roof decking. *The preliminary cost estimate should include a line item for 1,500 square feet of new 3" deep, 20 gage steel roof decking screwed through the plywood to the existing decking.*

- All unreinforced masonry perimeter bearing walls and all unreinforced masonry interior non-bearing walls will be connected to the existing roof deck. *The preliminary cost estimate should include a line item for an L8x6x½ x 12" long, at 4'-0" o.c. max, with 2-5/8" diameter x 5" embedment screen tube anchors into the existing masonry walls and 2-½" dia. x 2" long lag screws into the existing decking.*

- With reference to the May 13, 2011 *Existing Conditions Structural Report*, prepared by FBRA, the existing precast concrete veneer panels at the top portion the Reed Field House are damaged and will be replaced with new, metal panels and steel stud backup walls. Also, the existing steel channel girts at the top of the masonry will be reinforced for the current Code wind loading. *The preliminary cost estimate should include a line item for this work.* See Schematic Design Architectural Drawings for additional information.

- At the Auditorium, there is equipment above the stage which may be improperly hung and in need of resupport. Refer to the *Existing Conditions Structural Report* for additional information. *The preliminary cost estimate should include a line item to cover Metal Fabrications for resupport of this equipment.*

- At the existing tunnels below the slab on grade, new penetrations will be made in the tunnel walls to connect new duct work. At these locations, the existing slab on grade will be demolished, and the side wall of the existing concrete tunnel will be cut. After mechanical work is complete, the side wall of tunnel will be patched, the tunnel will be backfilled, and the adjacent slab on grade will be patched. *The preliminary cost estimate should include a line item for this work.* Refer to the Schematic Design Mechanical Drawings for additional information.

STRUCTURAL - OUTLINE SPECIFICATIONS

Cast in Place Concrete:

- All concrete shall be normal weight, 4,000 psi at 28 days, except foundation walls and footings, which shall be normal weight, 3,000 psi and exterior (exposed) concrete (paving) which shall be normal weight, 4,500 psi.

- Portland Cement: ASTM C150, Type I or II.

- Fly Ash: ASTM C618, Class F. Replacement of cement content with fly ash is limited to 20% (by weight). Fly ash is not permitted in exterior, exposed concrete, or in any slabs.

- Ground Granulated Blast-Furnace Slag – ASTM C 989 – Grade 100 or 120. Slag is not permitted in exterior, exposed concrete or during winter concreting conditions.

- All concrete shall be proportioned with 3/4” maximum aggregate, ASTM C 33, except 3/8” maximum aggregate shall be used at toppings less than 2” thick (e.g. metal pan stairs).

- All reinforcing shall be ASTM A 615 deformed bars, Grade 60.

- All welded wire fabric shall conform to ASTM A 185.

- Reinforcing bars, steel wire, welded wire fabric, and miscellaneous steel accessories shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with Submittal Requirements.

- Concrete products manufactured within 500 miles (by air) of the project site shall be documented in accordance with Submittal Requirements.

- Cure all concrete by moisture retention methods, approved by Architect; curing compounds shall not be used.

Structural Steel Framing:

- Structural steel shapes shall conform to ASTM A 992, Fy = 50 ksi.
- Rectangular steel tubes (HSS) shall conform to ASTM A 500, Grade B, Fy = 46 ksi.
- Round steel tubes (Pipe) shall conform to ASTM A 53, Grade B Fy = 35 ksi.
- Structural steel plates and bars shall conform to ASTM A 36, Fy = 36 ksi.
- Steel members shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with the Submittal Requirements.
- Steel manufactured within 500 miles (by air) of the project site shall be documented in accordance with the Submittal Requirements.
- Anchor Rods: Anchor rods at column base plates shall conform to ASTM F1554 – Grade 36 and shall be headed type. Provide a minimum of four (4), ¾" diameter anchor bolts at all columns; additional bolts and/or larger diameter will be required at bracing locations.
- Bolted connections shall be ASTM A 325, Type N (bearing) bolts, except slip-critical bolts shall be used at lateral brace beam connections.
- Shop and field welding shall be AWS D1.1 E70XX electrodes.
- Surface treatment for typical structural steel: SSPC Surface Preparation No. 3 (Power Tool Cleaning). Structural steel shall receive one (1) shop coat of rust inhibitive primer, except those areas to be fireproofed and surfaces to receive field welded shear connectors.
- Structural steel for corridor and (round HSS) cafeteria columns shall be Architecturally Exposed Structural Steel (A.E.S.S.) and shall meet the requirements of Section 10 of the AISC manual.
- Surface treatment for Architecturally Exposed Structural Steel: SSPC Surface Preparation No. 6 (Commercial Blast Cleaning). Exposed structural steel shall be primed with a premium architectural primer.
- All exterior, exposed structural steel shall be hot-dip galvanized.

Steel Joist Framing:

- All steel joists, joist accessories and workmanship shall be in accordance with Steel Joist Institute (SJI) standards.
- Steel joists shall be shop primed with a primer that is compatible with the finish paint.

Steel Decking:

- Typical steel roof deck shall be 1½" deep, 18 gauge, Type WR, conforming to ASTM A 653, Grade 33 (minimum), galvanized in accordance with ASTM A 653, coating class G-60. Exposed steel roof deck above the Gymnasium and classrooms shall be 3" deep, 20/20 gauge cellular acoustic deck and shall have a factory applied primer on the exposed bottom surface.

- All roof deck accessories (finish strips, closures, etc.) shall be the same finish as the deck; 18 gauge minimum.

- Steel deck shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with the Submittal Requirements.

- Steel deck manufactured within 500 miles (by air) of the project site shall be documented in accordance with the Submittal Requirements.

- Provide 14 gauge sump pans at roof drains.

SECTION 210000

FIRE PROTECTION

PART 1 - GENERAL

1.1 SCOPE

A. General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications Sections, apply to work of this Section.

1.2 CODES:

A. All work installed under this Section shall comply with NFPA 13, NFPA 14, NFPA 25 and all local, state, county, and federal codes, laws, statutes, and authorities having jurisdiction. Include any and all permits, connection, and/or inspection fees in the bid.

1.3 SCOPE OF WORK:

A. The work covered by this Section includes all Labor, Materials, and Operations in connection with the provision of a complete and operable Fire Protection System. Without limiting the generality thereof, the work includes, but is not necessarily limited to, the following:

1. Fire Service from 10' outside building.
2. A hydraulically designed combination automatic sprinkler system to provide 100% protection for the building. Prepare Working Drawings for approval of the Architect, the local authority having jurisdiction, and the owner's insurance company under stamp of an independent Massachusetts Registered Professional Fire Protection Engineer.
3. Double check valve assembly.
4. Fire department connections, pipe and fittings, valves, hangers, sprinkler heads, and system identification.
5. Flushing and testing of the entire system.

1.4 RELATED WORK:

A. The following related work is to be performed under other Sections of the Specifications:

1. Excavation and backfill – Division 31
2. Fire services to 10' outside foundation wall – Division 33

1.5 RECORD DRAWINGS:

A. Maintain on the site at all times one (1) set of black or blue line on white drawings which shall at all times be accurate, clear, and complete, showing the actual location of all piping and equipment as installed in colored pencil.

1.6 OPERATING INSTRUCTIONS AND MAINTENANCE MANUAL:

A. Provide operating instructions to the Owner's designated representative. At the completion of the project, turn over to the Architect two (2) complete manuals.

1.7 SHOP DRAWINGS AND MATERIAL SCHEDULES:

A. Submit as outlined in Division 1 including working drawings and hydraulic calculations.

1.8 GUARANTEE:

A. Guarantee all work free from defects in workmanship or materials for a period of one (1) year from the date of final acceptance of the building.

PART 2 - PRODUCTS

2.1 GENERAL:

A. All materials and equipment furnished under this Subcontract shall be new, unused, first quality of a manufacturer of established reputation. Each valve, fitting, section of pipe, piece of equipment, etc., shall have cast or indelibly stamped thereon the manufacturer's name, pressure rating where applicable, type, etc.

1. Drains and test connections shall be provided in the systems.

2.2 SPRINKLER PIPING:

A. Schedule 40 black steel pipe for 1-1/2" and smaller and Schedule 10 for 2" and larger.

2.3 SPRINKLERS:

A. Upright sprinkler heads in areas with no ceilings shall be Reliable Model "F1FR" Quick Response, upright natural bronze finish heads.

B. Sidewall heads shall be Reliable Model "F1FR" Quick Response with chrome plated head and escutcheon.

C. Pendent wet sprinkler heads shall be Reliable Model "F1FR" Quick Response recessed adjustable escutcheon, bright chrome plated.

D. Concealed heads shall be Reliable Model "G4A" Quick Response concealed type, 1-1/2" adjustment white cover plate. In special areas, as may be noted on the Drawings, provide alternate cover plate finishes.

E. Pendent dry sprinkler heads shall be Reliable Model "G3FR" Quick Response dry type, chrome plated adjustable escutcheon.

F. Dry sidewall heads shall be Reliable Model "G3FR" dry horizontal sidewall heads, bright chrome plated.

2.4 ALARM FACILITIES:

A. The wet system alarm device shall be Reliable or equal Model ‘E’ alarm valve with “E1” trimmings package to include Model ‘C’ water motor alarm and electric sprinkler alarm switch.

2.5 BACKFLOW PREVENTER:

A. Double check valve assembly shall be State approved, U.L./F.M. approved, with iron body bronze mounted construction complete with supervised OS & Y gate valves and test cocks. Furnish two (2) spare sets of gaskets and repair kits.

B. Double check valve assembly shall be of one of the following:

1. Watts Series 757-OSY
2. Wilkins 350A-OSY
3. Conbraco Series 4S-100
4. Or approved equal.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND INSTALLATION METHODS

A. All work shall be installed in a first-class manner consistent with the best current practices.

1. All piping shall be installed true to line and grade, shall be grouped together, be parallel to each other. Utilize gang hangers wherever feasible. Group all valves together where feasible.

3.2 CLEANING AND PROTECTION:

A. Protect all materials and equipment during shipment and installation, and properly handle and store at the job site so as to prevent damage, and upon completion of this work, clean all fixtures and equipment and replace damaged parts.

END OF SECTION

SECTION 220000

PLUMBING

PART 1 - GENERAL

1.1 CODES

A. All work installed under this Section shall comply with International Plumbing and Fuel Gas Code, ADA and all Local, State, County, and Federal Codes, Laws, Statutes, and Authorities having jurisdiction. Include any and all permits, connection, and/or inspection fees in the Bid.

1.2 WORK TO BE PERFORMED

A. The work covered by this section includes all labor, materials, and operations in connection with the provision of a complete and operable fire protection system. Without limiting the generality thereof, the work includes, but is not necessarily limited to, the following:

1. Sanitary Waste and Vent System.
2. Storm Drainage System.
3. Kitchen Waste and Vent including Grease Traps.
4. Acid Waste and Vent System including holding tank and monitoring system.
5. Domestic Hot and Cold Water System including Hot Water Heater.
6. Non-potable Hot and Cold Water System including Hot Water Heater.
7. Fuel Gas Piping System.
8. Fixtures and Equipment.
9. Testing and Chlorination.

1.3 RELATED WORK

A. The following related work is to be performed under other Sections of the Specifications:

1. Excavation and Backfill – Division 31
2. Sewer and Storm drain to 10' outside foundation – Division 33
3. Domestic Water Service to 10’ outside – Division 33
4. Electric Power Wiring: Section 260000
5. HVAC Equipment: Section 230000
6. Finish Painting: Section 09000
7. Installation of Access Panels: SECTION describing material in which panel is installed.
8. Toilet Room Accessories: Division 10

1.4 RECORD DRAWINGS

A. Maintain on the site at all times one (1) set of black or blue line on white drawings which shall at all time be accurate, clear, and complete, showing the actual location of all piping and equipment as installed in colored pencil. Prepare Record Drawings at the completion of the Contract.

1.5 OPERATING INSTRUCTIONS AND MAINTENANCE MANUAL

A. Provide operating instructions to the Owner's designated representative. At the completion of the project, turn over to the Architect four (4) complete manuals.

1.6 SHOP DRAWINGS AND MATERIAL SCHEDULES

A. Submit as outlined in Division 1.

1.7 GUARANTEE

A. Guarantee all work free from defects in workmanship and materials for a period of one year from the date of final acceptance of the Building.

1.8 SYSTEM IDENTIFICATION

A. Provide markers on all piping. Tag all valves in system with corresponding valve lists.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials and equipment furnished under this Contract shall be new, unused, first quality of a manufacturer of established reputation.

2.2 PIPING AND FITTING

A. Soil, Waste and Vent, Kitchen Waste and Vent, and Storm drainage piping to 10' outside shall be hubless cast iron pipe and fittings for 2" and above and shall be Type 'L' copper with cast D.W.V. type fittings for 1-1/2" and smaller.

B. Special Waste & Vent Schedule drainage piping to 10' outside the building shall be Schedule 40 electric heat fused flame retardant poly-propylene piping, fittings shall be Schedule 40 polypropylene fittings with electrical resistance heat fusion joints.

C. Potable and Non-Potable cold and hot water system water piping shall be Type 'L' hard tempered copper tubing with wrought copper fittings and silverbrite lead-free solder joints.

D. Fuel gas piping shall be Schedule 40, ASTM A-53, black steel with threaded malleable iron gas pattern fittings for gas piping.

2.3 VALVES

A. Locate all valves so as to isolate all parts of the system.

B. Shutoff valves 3" and smaller shall be ball valves, solder end or screwed.

C. Fuel gas valves shall be ball valves with tee handle, screwed end for 2-1/2" and smaller, and lubricated iron body plug cocks for 3" and larger.

D. Valves shall be by Apollo, Nibco, Watts or Rockwell.

2.4 INSULATION

A. All water piping shall be insulated with snap-on fiberglass insulation Type ASJ-SSL, equal to Certainteed 850 System, Owens Corning or Knauf.

2.5 CLEANOUTS

A. Cleanouts shall be full size up to 4"; threaded bronze plugs located as indicated on the drawings and/or where required in soil, waste and storm pipes.

2.6 ACCESS DOORS

A. Furnish access doors for access to all concealed parts of the plumbing system that require accessibility. Coordinate types and locations with the Architect.

2.7 DRAINS

A. Drains shall be cast iron, caulked outlets, nickaloy strainers, and in waterproofed areas and roofs shall have galvanized iron clamping rings with 6 lb. lead flashings to bond 9" in all directions. Drains shall be Smith, Zurn, or Josam.

2.8 PLUMBING FIXTURES

A. Furnish and install all fixtures, including supports, connections, fittings, and any incidentals to make a complete installation.

B. Fixtures shall bear the manufacturer's guaranteed label trademark indicating first quality. All acid resisting enameled ware shall bear the manufacturer's symbol signifying acid resisting material.

C. Vitreous china and acid resisting enameled fixtures, including stops, supplies and traps shall be of one manufacturer by Kohler, American Standard, or Toto. Supports shall be Zurn, Smith, or Josam. All fixtures shall be white. Faucets shall be Toto, Speakman, Symmons, or Chicago.

D. Fixtures shall be as scheduled on drawings.

1. Water Closet: Sloan high efficiency toilet, 1.28 gallon per flush, wall hung, vitreous china, siphon jet. Sloan sensor operated 1.28 gallon per flush-flush valve.
2. Urinal: Sloan Model #WES-1000, waterless urinal, wall hung, wall outlet, vitreous china.
3. Lavatory: Sloan wall hung/countertop ADA lavatory. Sloan infra-red, sensor mixing faucet, 0.5 GPM aerator. Faucet shall be programmed for a 10 second cycle.
4. Sink: Just SL-ADA-1921-A-GR single bowl, 19" x 21" x 5-1/2" deep self rimming countertop mounted, 18 GA type 304 stainless steel sink with offset rear outlet; three (3) hole punched faucet ledge & quick clip mounting system, sound deadening underside. Chicago #201A-GN8A-E2805-5CP-317 concealed deck faucet with 8" swing gooseneck spout, 4" wrist blade handles, E-2805 0.5 GPM aerator.
5. Drinking Fountain: Halsey Taylor hi-low wall mounted electric water cooler, stainless steel basin.
6. Janitor Sink: Stern-Williams Model MTB-2424, 24" x 24" x 10", mop service basin with stainless steel rim guard on exposed sides, 3" caulk connection, stainless steel strainer. Include caulking and sealant to seal between unit and finished wall and floor. Chicago 897-CP service sink fitting.

2.9 WATER HEATER

A. (2) Gas-fired, tank-type water heater P.V.I. Inc., A.O. Smith or RBI.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND INSTALLATION METHODS

A. All work shall be installed in a first-class manner consistent with the best current practices.

1. All piping shall be installed true to line and grade, shall be grouped together, be parallel to each other. Utilize gang hangers wherever feasible. Group all valves together where feasible.

3.2 CLEANING AND PROTECTION

A. Protect all materials and equipment during shipment and installation, and properly handle and store at the job site so as to prevent damage, and upon completion of this work, clean all fixtures and equipment and replace damaged parts.

3.3 SLEEVES AND ESCUTCHEONS

A. Furnish and install in masonry walls and floors, galvanized steel sleeves as required.

3.4 TESTING

A. Test all work in the presence of the Architect and/or Engineer and as required by local codes.

3.5 CHLORINATION

A. Upon completion of the plumbing work, thoroughly chlorinate the entire domestic water system before putting same in service.

END OF SECTION

SECTION 230000

HVAC

PART 1 – GENERAL

1.1 CODES

A. All work installed under the HVAC Section shall comply with the Town of Lincoln Building Code and all state, county, and federal codes, laws, statutes, and authorities having jurisdiction.

1.2 DESIGN INTENT AND SYSTEM DESCRIPTION

A. The work of this Section is shown on the drawings. All work is new and consists of furnishing all materials, equipment, labor, transportation, facilities, and all operations and adjustments required for the complete and operating installation of the Heating, Ventilating and Air Conditioning work and all items incidental thereto, including commissioning and testing.

B. Capacities of systems and equipment are indicated in the attached HVAC system narrative.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials and equipment furnished under this section shall be new, unused, first quality of a manufacturer of established reputation.

2.2 PIPING AND FITTINGS

A. Hydronic piping shall be Schedule 40 ASTM A-53, black steel pipe with butt welded ends and fittings on 3" and above and threaded ends and fittings on 2-1/2" and smaller. At the contractor option type "L" copper may be used on all 2-1/2" and smaller.

2.3 VALVES

A. All valves shall be bronze, brass, or cast iron as system design requires. Locate all valves so as to isolate all parts of the system and as required for normal system operation.

1. Available Manufacturers: Subject to compliance with the requirements of the contract documents provide valves of the following manufacturer:

a. Milwaukee
b. Stockham
c. Nibco

2.4 SYSTEM IDENTIFICATION

A. Provide markers on all piping and equipment. Tag all valves in system with corresponding valve lists.

2.5 INSULATION

A. All piping shall be insulated with snap-on fiberglass insulation with all service jacket. Fittings shall be insulated with snap on pre-molded covers with loose fill fiberglass insulation.

B. All HVAC supply and return ductwork shall be insulated with 1" thick fiberglass blanket with a foil vapor barrier. All outside air intake ductwork shall be insulated with 2" rigid fiberglass with foil vapor barrier.

2.6 FIN TUBE RADIATION

A. Commercial slope top fin-tube with steel tube and steel fin. Cover shall be 14 ga. with baked enamel factory finish. All units shall be provided with full backplate, damper, end covers, and splice pieces for a complete installation.

1. Available Manufacturers: Subject to compliance with the requirements of the contract documents provide fin-tube radiation of the following manufacturer:

a. Sterling
b. Vulcan
c. Ritling

2.7 RADIANT PANELS

A. The radiant panels will have a minimum heating output of 200 Btu/Hour/Square Foot at 170°F mean water temperature when the room air temperature is 70°F, the roof is of medium insulation value, and natural convection prevails in the room. Panels widths shall be as indicated or scheduled on the drawings.

B. Radiant panel shall be manufactured utilizing extruded aluminum strips of approximately 0.115 overall thickness. The strips shall have a minimum 0.495 I.D. copper tube firmly attached to aluminum extrusion under all operating temperature conditions. Ends of tubes shall be swaged to 0.569 I.D. for proper soldering fit of ½ inch Type "L" soft copper tubing.

1. Available Manufacturers: Subject to compliance with the requirements of the contract documents provide fin-tube radiation of the following manufacturer:

a. Rittling
b. Sun-El
c. Sterling
d. Aero Tech

2.8 UNIT HEATERS

A. Horizontal or cabinet type with exact location to be determined. All units shall be provided with fan and aquastat control.

1. Available Manufacturers: Subject to compliance with the requirements of the contract documents provide unit heaters of the following manufacturer:

a. Trane
b. Sterling
c. Ritling

2.9 PUMPS

A. Base mounted bronze fitted with high efficiency electric motor. Provide primary and stand-by pump for each system with manual alternator and pilot lights.

1. Available Manufacturers: Subject to compliance with the contract documents provide pumps of the following manufacturer:

a. Bell & Gossett
b. Taco
c. Armstrong

2.10 BOILERS

A. High efficiency gas fired condensing hot water boiler. Power burners shall be fully modulating.

1. Manufacturer: Subject to compliance with the above, provide high efficiency gas fired condensing boiler of one of the following:

a. Burderus
b. Viessmann
c. Aerco

2.11 INDOOR AND ROOFTOP AIR HANDLING UNITS (HVAC 100% O.A.)

A. All units shall be of the draw thru 100% outdoor air design and shall be provided with hot water heating coil, chilled water cooling coil, energy recovery wheel with VFD, filters (MERV-13), dampers, and centrifugal supply and return air fan with motor.

1. Outdoor units shall be provided with a pre-fabricated penthouse with service access
2. Indoor units shall be located at the floor level on concrete pads. Ceiling mounted units are not acceptable.
3. Available Manufacturers: Subject to compliance with the requirements of the contract documents provide rooftop air handling units of the following manufacturer:

a. NuClimate
b. Seasons 4
c. MAFNA

2.12 INDOOR AND ROOFTOP AIR HANDLING UNITS (HVAC Recirculation)

A. All units shall be of the draw thru type provided with hot water heating coil, chilled water cooling coil, filters (MERV-13), dampers, and centrifugal supply and return air fan with motor.

1. Outdoor units shall be provided with a pre-fabricated penthouse with service access
2. Indoor units shall be located at the floor level on concrete pads. Ceiling mounted units are not acceptable.
3. Available Manufacturers: Subject to compliance with the requirements of the contract documents provide rooftop air handling units of the following manufacturer:

a. NuClimate
b. Seasons 4
c. MAFNA

2.13 HEATING AND VENTILATING UNITS

A. All units shall be of the draw thru type and shall be provided with hot water heating coil, filters (MERV-13), dampers, and centrifugal supply and return air fan with motor.

1. Available Manufacturers: Subject to compliance with the requirements of the contract documents provide rooftop air handling units of the following manufacturer:

a. NuClimate
b. Seasons 4
c. Greenheck

2.14 MAKE-UP AIR UNITS

A. All units shall be of the draw thru 100% outdoor air design and shall be provided with filters (MERV-13), dampers, and centrifugal supply and return air fan with motor.

1. Available Manufacturers: Subject to compliance with the requirements of the contract documents provide rooftop air handling units of the following manufacturer:

a. Sterling
b. Greenheck
c. Reznor

2.15 INDUCTION TERMINAL UNIT

A. Induction terminal units shall be constant volume primary air flow units designed to induce a secondary airflow within the conditioned space using the primary conditioned air supply. Units shall be designed for ceiling installation with factory supplied hanger supports. Units shall be equipped with primary air intake, combination supply / return air grille for room air distribution, air plenum and air induction nozzles (internal to the unit) and hot water/chilled water coil.

1. MANUFACTURER: Subject to compliance with requirements, provide air induction units of one of the following:

a. NuClimate
b. M & I
c. MAFNA

2.16 LIQUID CHILLER

A. Unit shall be multiple stage control and shall be of the copper tube aluminum fin design and shall be provided with semi-hermetic compressors and chiller barrel. Minimum capacity control of 20% shall be provided.

1. Available Manufacturer: Subject to compliance with the requirements of the contract documents provide liquid chiller unit of the following manufacturer:

a. Trane
b. York
c. McQuay

2.17 DUCTWORK

A. All ductwork shall be galvanized steel with all seams sealed. Entire ductwork system shall be fabricated and installed per SMACNA LOW PRESSURE DUCT CONSTRUCTION STANDARDS. All high velocity ductwork, between air handling unit and VAV box (where applicable), shall be spiral wound round and flat oval.

2.18 DIFFUSERS, REGISTERS AND GRILLES

A. All devices shall be steel welded construction with diffusing vanes and baked enamel finish.

1. Available Manufacturers: Subject to compliance with the requirements of the contract documents provide diffusers, registers, and grills of the following manufacturer:

a. Tuttle & Bailey (RC)
b. Price
c. Nailor Industries (vaned)
d. Metalaire (IV)

2.19 DISPLACEMENT DIFFUSERS

A. All devices shall be steel welded construction with perforated face and baked enamel finish.

1. Available Manufacturers: Subject to compliance with the requirements of the contract documents provide displacement diffusers of the following manufacturer:

a. Price
b. Metalaire
c. Titus

2.20 EXHAUST FANS

A. Exhaust fans shall be galvanized steel construction with centrifugal fan and belt drive motor. Each roof unit shall be provided with 12" high pre-fab curb with motor operated damper in curb.

1. Available Manufacturers: Subject to compliance with the requirements of the contract documents provide exhaust fans of the following manufacturer:

a. Greenheck
b. Cook
c. Twin City

2.21 AUTOMATIC TEMPERATURE CONTROLS

A. System shall be a direct digital control and building energy management system to provide complete automatic temperature control and monitoring of newly installed HVAC system.

1. Available Manufacturers: Subject to compliance with the requirements of the contract documents provide automatic temperature controls of the following manufacturer:

a. Johnson Controls
b. Honeywell
c. Allerton
d. Delta

PART 3 - EXECUTION

3.1 WORKMANSHIP AND INSTALLATION METHODS

A. All work shall be installed in a first-class manner consistent with the best current practices.

1. All piping shall be installed with slope for proper drainage shall be grouped together, and be parallel to each other. Utilize gang hangers wherever feasible. Group all valves together where feasible.

3.2 CLEANING AND PROTECTION

A. Protect all materials and equipment during shipment and installation, and properly handle and store at the job site so as to prevent damage, and upon completion of this work, clean all fixtures and equipment and replace damaged parts.

3.3 SLEEVES AND ESCUTCHEONS

A. Furnish and install in masonry walls and floors, galvanized steel sleeves as required. Provide escutcheons where sleeves and pipe penetrations are exposed to view.

3.4 FIRESAFING

A. At all sleeved walls and floors provide firesafe caulking, packing, blanket etc., for a completely tight system to prevent the passage of smoke and fire.

3.5 TESTING, ADJUSTING, COMMISIONING AND BALANCING

A. Requirements include measurement and establishment of the quantities of the mechanical systems as required to meet specifications, and recording and reporting the results. Test, adjust and balance the following mechanical systems:

1. Supply air systems.
2. Return air systems.
3. Exhaust air systems.
4. Outside air systems.
5. Hydronic heating and cooling systems.
6. Verify temperature control system operation.

B. Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders.

C. An independent testing, adjusting, and balancing agency certified by the AABC or NEBB as a Test and Balance Engineer in those testing and balancing disciplines required for this project.

3.6 OPERATION MANUALS AND MAINTENANCE MANUALS:

A. Refer to the contracts specifications for a complete outline of all requirements of operations and maintenance data.

3.7 RECORD DRAWINGS AND CONTROL DOCUMENTS:

A. Refer to the contracts specifications project record documents for a complete description of all requirements of recording as built record documents.

3.8 ENERGY REBATE PROGRAM

A. This project has been designed to incorporate equipment approved for energy rebate such as boilers, high efficiency motors, chillers, etc. Meet with Utility Company prior to submitting shop drawing to ascertain that submittal meets program guidelines.

END OF SECTION

SECTION 260000

ELECTRICAL

PART 1 - GENERAL

1.1 TIME, MANNER AND REQUIREMENTS FOR FILING SUB-BIDS

A. Sub-Bid shall be submitted in accordance with the provisions of General Law, Chapter 149, Section 44A to 44I, inclusive, as amended.

B. Sub-Bids for Work under this Section shall be received at the location indicated on the Invitation for Bids.

C. All Sub-Bids shall be submitted on the "Form of Sub-Bid" furnished by the Awarding Authority as required by Section 44G of Chapter 149 of the General Laws, as amended. The Bid Forms attached herein are for information only and shall not be detached, filled in, or executed. Sub-Bids which are incomplete, conditional, obscure, or which contain additions not called for will be rejected.

D. Sub-Bids filed with the Awarding Authority shall be accompanied by a Bid Deposit in the form of a certified check or a treasurer's or cashier's check issued by a responsible bank or trust company, payable to the Owner, a bid bond shall be:

1. On a form satisfactory to the Awarding Authority.
2. With a surety company qualified to do business in the Commonwealth of Massachusetts, and satisfactory to the Awarding Authority.
3. Conditioned upon the faithful performance by the principal of the agreements contained in the BID. The amount of the bid deposit shall be five percent (5%) of the value of the bid.

E. Sub-Bids for work under this Section shall be for the complete work required as specified and as shown on the Drawings. Work to be performed under this Filed Sub-Bid is included in the Contract Documents as indicated in the Filed Sub-Bid Coordination document included in the Bidding and Contract Requirements of this Project Manual.

F. Sub-Bidders must comply with all provisions of Division 01 General Requirements, in the same manner as the Contractor.

1.2 GENERAL

A. The General Conditions and Supplementary General Conditions of these specifications are hereby made a part of this Section.

B. Refer to drawings for further definition of location, extent, and details of work described herein.

C. Cooperate and coordinate with other trades in executing work as described in this Section.

D. Where referred to, Standard Specifications, Recommendations of Technical Societies, and/or Manufacturer's Associations, plus Codes of Federal, State, and Local Agencies shall include all amendments current as of date of issue of these specifications.

1.3 SUMMARY

A. Work described herein shall be interpreted as work to be done by the Electrical Contractor. Work to be performed by other trades will be referenced to a particular contractor.

B. Provide all labor, materials, tools, and equipment, including scaffolding, to complete the installation of the electrical system. Install, equip, adjust, and put into operation the respective portions of the installation specified, and so interconnect various items or sections of work in order to form a complete and operating whole. The work shall consist of, but shall not necessarily be limited to, the following:

1. Primary, secondary and low tension ductbanks, manholes, handholes, etc.
2. Secondary distribution equipment, including secondary switchboard and metering, motor controls, variable frequency drives, dry-type transformers, distribution panels, and panelboards, including feeders and subfeeders.
3. Fire alarm system, addressable type.
4. Emergency power system, including diesel fueled emergency generator, emergency lighting and exit signs. The existing 160 kw diesel generator will be reused for optional standby loads.
5. Lighting systems exterior and interior, including lamps, fixtures, occupancy sensors, controls, etc.
6. All raceway systems, including boxes, couplings, and fittings.
7. All branch circuit wiring systems, including wiring devices, plates, etc.
8. Excavation and backfill within building foundation walls for any underground raceways.
9. Connections for all building equipment, including mechanical, plumbing, fire protection, and the like.
10. All testing of equipment installed.
11. Any other item of work hereinafter specified or indicated on electrical drawings.
12. Drilling, coring, and cutting of holes (where the largest dimension thereof does not exceed 12 inches) for electrical conduit systems, and equipment.
13. Systems Identification.
14. Scaffolding, Rigging, and Staging required for all Electrical Work.
15. Hardware – coordinate with Finish Hardware.
16. Fire stopping shall be performed by this contractor.
17. Provide Seismic Restraints for all Electrical Systems conforming to the requirements of State Code.
18. Coordination Drawings.
19. Provide cable tray, 120 volt power sources, raceways and backboxes for Paging System, Clock System, Voice, Data and Video Systems, etc. as specified in Section 270000.
20. Lightning Preventor System.
21. Temporary Power and Lighting.
22. Electronic Scoreboards & Shot Clocks.
23. Alternates affecting this Section.
24. Security/Intrusion System.
25. Closed Circuit TV (CCTV) System
26. Card Access System.
27. Auditorium theatrical lighting and dimming system.

1.4 DEFINITIONS

A. Most terms used within the documents are industry standard. Certain words or phrases shall be understood to have specific meanings as follows:

1. Provide: Furnish and install completely connected up and in operable condition.
2. Furnish: Purchase and deliver to a specific location within the building or site.
3. Install: With respect to equipment furnished by others, install means to receive, unpack, move into position, mount and connect, including removal of packaging materials.
4. Conduit: Raceways of the metallic type which are not flexible. Specific types as specified.
5. Connect: To wire up, including all branch circuitry, control and disconnection devices so item is complete and ready for operation.
6. Subject to Mechanical Damage: Equipment and raceways installed exposed and less than eight feet above finished floor in mechanical rooms or other areas where heavy equipment may be in use or moved.

1.5 ITEMS TO BE FURNISHED ONLY

A. Furnish the following items for installation under designated sections.

1. Duct smoke detectors installed under Section 23 00 00 – HVAC.

1.6 ITEMS TO BE INSTALLED ONLY

A. Install the following items furnished under designated sections.

1. Technology system specialty back boxes- Section 27 00 00.

1.7 RELATED WORK

A. The following related work is to be performed under designated sections.

1. Excavation and Backfill: DIVISION 31 - SITE WORK (except within building foundation).
2. Concrete Bases, Pads and Duct Envelopes: SECTION 03 30 00, CONCRETE.
3. Finish Painting: SECTION 09 90 00, PAINTING.
4. Automatic Temperature Control: SECTION 23 00 00, HEATING, VENTILATING, AND AIR CONDITIONING.
5. Payment for energy for temporary light and power shall be made by General Contractor.

1.8 CONTRACT COST BREAKDOWN

A. Submit a breakdown of contract price to aid Architect in determining value of work installed as job progresses.

1.9 INSPECTION OF SITE

A. Electrical bidders will be permitted to inspect site. Failure to inspect existing conditions or to fully understand work which is required shall not excuse Electrical Subcontractor from his obligations to supply and install work in accordance with specification and drawings and under site conditions as they exist.

1.10 CONTRACTOR'S REPRESENTATIVE

A. Retain a competent representative on the project.

1.11 COOPERATION

A. Work shall be carried on under usual construction conditions, in conjunction with other contractors work. Cooperate with other contractors, coordinate work and proceed in a manner as not to delay progress.

1.12 CODES, ORDINANCES, AND PERMITS

A. Codes and Ordinances:

1. NFPA 70 – National Electrical Code – (NEC) 2011

a. NFPA 101 – Life Safety Code
b. NFPA 72 – National Fire Alarm Code
c. Underwriters Laboratories, Inc. UL Standards
d. National Electrical Manufactures Association (NEMA) standards
e. Institute of Electrical & Electronic Engineers (IEEE), applicable publications
f. Illuminating Engineering Society of North America (IESNA), applicable publications
g. CHPS

2. Code Design Requirements:

a. Main service shall be designed per NEC Article 230 – Services.
b. Grounding shall be in accordance with NEC Article 250 – Grounding
c. Lighting, Electrical Distribution, Receptacles, General Power, Telephone, Fire Alarm, Data Network, Intrusion, and Lightning Protection shall be designed in accordance with the National Electrical code (NEC) 2011 and all local codes that may apply.
d. Fire Alarm Systems shall be designed per NFPA 70, 101, 72, 25.
e. All wiring shall be in compliance with the National Electrical Code – (NEC) 2011

B. Permits: Be responsible for filing documents, payment of fees, and securing of inspection and approvals. See allowances for backcharges for utility company work in conjunction with the permanent electric service.

1.13 ELECTRICAL ROOMS OR SPACES

A. Be responsible for ensuring that the dedicated space and clearances required in the NEC, Sections 110-16 and 110-26 are maintained for all electrical equipment.

1.14 SUBMITTALS

A. Refer to Supplementary General Conditions for information relative to submission of shop drawings. Six (6) copies are required. No equipment for which review is required shall be installed prior to review, except at Contractor's own risk.

1.15 GUARANTEE

A. Keep work in repair without expense to Owner as far as concerns defects in workmanship or materials for a period of not less than one year from date of substantial completion.

1.16 ELECTRICAL CHARACTERISTICS

A. In general, and unless specifically indicated otherwise, all building service, heating, ventilating, air conditioning, and plumbing equipment shall be of the following characteristics.

1. Motors up to and including 1/3 HP shall be suitable for 120 volts, one phase operation.
2. Motors larger than 1/3 HP shall be suitable for 480 volts, three phase operation.
3. Electric heating equipment 4 KW and less shall be suitable for 277 volt single phase operation. Over 4 KW shall be 480 volt three phase.

B. Power Factor: All equipment provided rated greater than 1,000 watts and lighting equipment greater than 15 watts with an inductive reactance load component shall have a power factor of not less than 90% under rated load conditions.

1.17 RECORD DRAWINGS

A. Provide two (2) sets of black or blue line on white drawings to maintain and submit record drawings, one set shall be maintained at site and which shall be accurate, clear, and complete showing actual location of all equipment as installed.

B. Any addenda sketches and supplementary drawings issued during course of construction shall be attached to drawings.

C. At completion, submit an accurate checked set of drawings.

D. After approval of these drawings, photo reproductions of original tracings shall be revised to incorporate changes, including addenda sketches and supplementary drawings.

1.18 TEMPORARY LIGHT & POWER

A. Refer to Division 01 General Requirements.

1.19 TEMPORARY ELECTRICAL SUPPORT FACILITIES

A. Refer to Division 01 General Requirements.

B. Provide own field office and/or storage facilities which shall be located as directed or permitted by General Contractor and in accordance with local regulations. Provide all tools, equipment, ladders, and temporary construction required for execution of the work.

C. All scaffolding, ladders, and other temporary construction shall be rigidly built in accordance with all local and state requirements, and shall be removed upon completion.

1.20 INSPECTIONS AND TESTS

A. Inspection: If inspection of materials installed shows defects, such defective work, materials, and/or equipment shall be replaced and inspection and tests repeated.

B. Tests: Make reasonable tests and prove integrity of work and leave electrical installation in correct adjustment and ready to operate. All panels and switchboards shall have phases balanced as near as practical. A consistent phase orientation shall be adhered to all terminations.

1.21 ENERGY REBATE PROGRAM

A. This project has been designed to incorporate equipment approved for energy rebate such as fixtures, ballasts and lamps. This project will be designed in compliance with the “Advanced Core Performance Building” Program.

1.22 OWNER FURNISHED EQUIPMENT

A. The owner will furnish certain materials which will be installed and wired under this Section of the specifications. Owner furnished equipment will be specified under the Product Sections of these Specifications.

1.23 INSTRUCTIONAL TECHNOLOGY SYSTEM (I.T.S.)

A. This contractor shall work closely with the I. T.S. Contractor to assure a first class installation. Coordinate all back boxes and conduits required prior to installation. In general, the electrical contractor shall provide outlet boxes and conduits from (I.T.S. equipment) outlets to accessible ceiling space.

PART 2 - PRODUCTS

2.1 GENERAL

A. Product specifications are written in such a manner so as to specify what materials may be used in a particular location or application and therefore do not indicate what is not acceptable or suitable for a particular location or application. As an example: non-metallic sheathed cable is not specified; therefore, it is not acceptable.

B. All material shall be new and shall be UL listed.

2.2 RACEWAYS AND FITTINGS

A. Raceways - General:

1. No raceway shall be used smaller than 3/4" diameter and shall have no more than four (4) 90^{o} bends in any one run, and where necessary, pull boxes shall be provided. Only rigid metal conduit or intermediate metal conduit is allowed for in-slab work. Cable systems, if allowed to be used by other sections of this specification, shall not be used exposed or in slabs, whether listed by "UL" for such use or not.
2. Rigid metal conduit, may be used for service work, exterior work, slab work, and below grade level slab, wet locations, and in penthouse for drops down to equipment from elevations above eight feet and also where raceway may be subject to mechanical damage.
3. Electrical Metallic Tubing (EMT), may be used in masonry block walls, stud partitions, above furred ceilings, where exposed but not subject to mechanical damage, and shall be used for fire alarm work.
4. Surface metal raceways shall be used where raceways cannot be run concealed.
5. Flexible metal conduit shall be used for final connections to recessed lighting fixtures from above ceiling junction boxes and for final flexible connections to motors and other rotating or vibrating equipment. Liquid tight flexible metal conduit shall be used for the above connections which are located in moist locations. All flexible connections shall include an insulated grounding conductor.

6. Rigid non-metallic conduit may be used at the contractors option for underground electric and telephone services outside the foundation wall and shall be polyvinyl chloride (PVC) schedule 40, 90°C. If option of rigid non-metallic conduit is exercised, underground runs outside the foundation wall shall be concrete encased at electrical contractors expense.
7. PVC Schedule 40 may also be used for below slab circuits within building confines and site lighting branch circuits. Below slab rigid non-metallic conduits do not require concrete encasement. Rigid non-metallic conduits shall not be used for exterior feeders, in slabs, nor for elbows which penetrate slabs. Raceways and fittings shall be produced by same manufacturer.
8. Acceptable manufacturers:

   Pittsburgh Standard Conduit Company
   Republic Steel and Tube
   Youngstown Sheet and Tube Company
   Carlon

B. Outlets, Pull and Junction Boxes:

1. Outlets:

   a. Each outlet in wiring or raceway systems shall be provided with an outlet box to suit conditions encountered. Boxes installed in normally wet locations or surface mounted shall be of the cast-metal type having hubs. Concealed boxes shall be cadmium plated or zinc coated sheet metal type. Old work boxes with Madison clamps not allowed in new construction. Thru the wall boxes are not permitted.

   b. Acceptable manufacturers:

      Appleton
      Crouse Hinds
      Steel City
      RACO

2. Pull and Junction Boxes: Where indicated on plans, and where necessary to terminate, tap off, or redirect multiple raceway runs or to facilitate conductor installation, furnish, and install appropriately designed boxes. Boxes shall be fabricated from code gauge steel assembled with corrosion resistant machine screws. Box size shall be as required by Code.

   a. Acceptable Manufacturers:

      Brasch
      Hoffman
      Keystone
      Lee Products Co.
      McKinstry Inc.
      Eldon Inc.

2.3 CONDUCTORS

A. All conductors shall be a minimum size of #12 AWG except for control wiring and fire alarm wiring where #14 AWG may be used. For all exit sign circuits, normal/emergency and/or emergency only circuits, exterior lighting circuits, and also where distance from panelboard to first outlet exceeds 80' for 120 volts and 150’ for 277 volts, #10 AWG shall be minimum size wire allowed. All feeder and branch circuit conductor shall be color coded as follows:

1.	208Y/120V	Phase A	Black
2.	208Y/120V	Phase B	Red
3.	208Y/120V	Phase C	Blue
4.	480Y/277V	Phase A	Brown
5.	480Y/277V	Phase B	Orange
6.	480Y/277V	Phase C	Yellow
7.	Grounded Conductor		
		120/208	White
		277/480	Grey
8.	Equipment Ground		
		120/208	Green
		277/480	Green with Yellow Trace

B. All conductors not installed in accordance with color scheme shall be replaced. All conductors larger than #6 AWG must be identified with colored tape.

C. Connections throughout the entire job shall be made with solderless type devices.

1. For #10 AWG and smaller: spring type.
2. For #8 AWG and larger: circumferential compression type.
3. Acceptable manufacturers:

   3M "Scotchlock"
   IDEAL "Wingnut"
   BURNDY
   MAC

4. Any splices made up in ground mounted pull boxes shall be resin cast waterproof type or waterproof pressure type, as manufactured by King Technology, St. Louis, MO.

D. Conductors shall be copper, soft drawn, and annealed of 98% conductivity. Conductors larger than #10 AWG shall be stranded; #10 AWG and smaller shall be solid. Conductors shall be insulated for 600 volts and be of following types:

1. All conductors shall have heat/moisture resistant thermoplastic insulation type THHN/THWN (75^{o}C) except as follows:

   a. In sizes #1 AWG and larger: Crosslinked polyethylene insulation type XHHW (75^{o}C - 90^{o}C) may be used.
   b. Fire alarm system conductors shall be #14 AWG, type THHN, solid. Color coding of fire alarm conductors shall be in accordance with fire codes.
   c. Fixture whips #16AWG type "SF".

E. Stranded conductors for all wiring systems except fire alarm will be allowed if installed and terminated as specified under Execution Section.

F. Mineral-Insulated Metal-Sheathed Fire-Resistive Cables (Type MI) - Cables shall consist of a factory assembly of one or more solid copper conductors insulated with highly-compressed magnesium oxide and enclosed in a seamless, liquid-and-gas-tight continuous copper sheath. Cables shall be rated for 600 volts and less. Cables shall comply with Article 330 of the National Electrical Code. Cables shall be classified by Underwriters Laboratories, Inc. as having a 2-hour fire resistive rating. Cable terminations shall be made with UL listed mineral-insulated cable fittings. Approved Manufacturer - Pyrotenax USA, Inc., or equal.

G. Type MC cable may be used for concealed branch circuits in hollow spaces where allowed by code if installed and terminated as specified under Execution Section. Armor to be galvanized steel, and shall be UL listed for 2 hour thru-wall fire penetration.

H. Acceptable manufacturers:

American Flexible Conduit Company
American Wire & Cable
Anaconda
Cerro
Cornish
Cresent
Essex
Okonite
Rome

2.4 ACCESS PANELS

A. Provide access panels for access to concealed junction boxes and to other concealed parts of system that require accessibility for operation and maintenance. In general, electrical work shall be laid out so access panels are not required.

B. Access panels shall be prime painted and equipped with screwdriver operated cam locks.

C. Acceptable manufacturers:
Inland Steel Products Company - Milcor
Miami Carey
Walsh-Hannon-Gladwin, Inc. - Way Locator
Specific types:

1. Acoustical Tile Ceiling "Milcor Type AT"
2. Plastered Surfaces “Milcor Type K"
3. Masonry Construction "Milcor Type M"
4. Drywall Construction "Milcor Type DW”

2.5 SLEEVES, INSERTS, AND OPENINGS

A. Sleeves: Provide sleeves of proper sizes for all openings required in concrete floors and walls. Sleeves passing through floors shall be set with top of sleeve 1" above finished floor. Core drilling will also be acceptable if in accordance with any structural standards. Any unsleeved openings shall be waterproofed.

2.6 FLOOR OUTLETS (FLUSH TYPE)

A. All flush floor outlets shall be Steel City 640 or 840 series cast iron, watertight type. The 640 series shall be used generally, and the 840 series used where shallow depth is required.

B. Whenever floor outlets for different services are indicated in the same location, they shall be ganged together.

C. Covers shall be brass series P64. Duplex receptacle covers shall be lift lid type P64DS. Low tension covers shall be series P64-3/4-2 with 3/4" diameter and 2" diameter plugs. Flush floor outlets located in carpeted areas shall be provided with P64-CP carpet plates of the number of gangs required.

2.7 WIRING DEVICES

A. Receptacles: Receptacles shall be flush mounted. All standard 20 ampere devices to be of same manufacturer

Acceptable Manufacturers:

Twenty (20) ampere duplex grounding type NEMA 5-20R,
Arrow Hart 5739SI,

Thirty (30) ampere, 250 volt NEMA 10-30R complete with plate,
Arrow Hart 9344,

B. Switches: 20 ampere,
Arrow Hart 1991 series,

C. Composition material of wiring devices to be nylon with white finish.

D. Coverplates: Brushed US 302 stainless steel.

Provide gaskets on all wiring device plates where devices are on walls separating conditioned and non-conditioned spaces.

E. Blank coverplates shall be steel, paintable.

F. Dimmer Controls:

1. All devices shall be UL listed specifically for the required loads (i.e., incandescent, fluorescent, magnetic low voltage, electronic low voltage). Manufacturer shall provide file card upon request. Universal dimmers are not acceptable.

2.8 LIGHTING FIXTURES

A. Provide lighting fixtures complete with lamps, ballasts, and other devices as required for a first class installation. Furnish Ceiling Subcontractor with instructions concerning openings necessary, and provide frames for NEMA standard ceiling types or special mounting frames, as may be required. Fixtures shall be supported independently of hung ceiling construction.

B. Electronic ballasts shall be equal to Advance Mark V in single, two, and three lamp versions and input current total harmonic Distortion not exceeding 20% but not less than 10%.

C. Standard incandescent lamps shall be wattmiserplus inside frosted/99 long life (2500) hours unless otherwise specified and rated at 130 volts.

D. All T-5 fluorescent lamps shall be Sylvania Pentron 3000°K or equal.

E. Provide universal arrows on all exit signs and punch out directions as shown on floor plans.

F. Pendant mounted fixtures shall be suspended by means of air craft cable with aligner and canopy in finished areas or threaded rods in non-public areas. Length of suspension method to be as required to mount fixtures at the elevations called for or as otherwise shown on drawings or architectural elevations.

G. Fixture types shall be as scheduled.

2.9 ELECTRICAL POWER EQUIPMENT

A. Motors: Each motor shall have disconnect switch and starter provided under this section. Starters which are a part of "factory assembled" control panel will be provided under section supplying equipment to be controlled but connected under this section.

1. Provide motor terminal boxes for each motor not furnished with same.

B. Disconnect Switches:

1. Disconnect (safety) switches shall conform to industrial standards of NEMA, be UL listed and shall be heavy duty type, quick-make, quick-break type with interlocking cover mechanism and provisions for padlocking switch handle in "OFF" position. Three pole toggle switches are not acceptable as substitute for disconnect switches.

2. Acceptable Manufacturers:

General Electric
Westinghouse
Square D/Groupe Schneider
Siemens
Allen Bradley

C. Fuses:

1. Provide a complete set of fuses for each item of fusible type equipment. Fusible equipment furnished by other contractors will be complete with fuses, unless noted otherwise on electrical drawings.

2. Acceptable Manufacturers:

Bussmann, Division of McGraw
Gould/Shawmut
GEC-ALSTHOM

2.10 ELECTRICAL SYSTEM CONTROLS AND INSTRUMENTS

A. Provide a complete power system consisting of branch circuits, motor disconnect switches, pushbutton stations, motor starters, and other devices to connect up and leave in operating condition each piece of electrically operated equipment provided either under this section or other Divisions.

B. All control wiring not indicated in the electrical specifications or not shown on electrical drawings will be provided by Temperature Control Subcontractor.

2.11 GROUNDING SYSTEM

A. All equipment and systems shall be grounded. Refer especially to NEC Section 250 Requiring Connections to Building Steel, Foundation, Water Service, and Interior Piping. Provide transformer pad grounding to be in accordance with utility company standards.

2.12 MAIN BUILDING SWITCHBOARD

A. Main building switchboard shall be constructed in accordance with UL 891 and ANSI standards and of the required number of vertical sections bolted together to form one metal enclosed rigid structure. The front shall be accessible. Buses shall be copper.

B. Switchboard shall be arranged for operation as follows:

Voltage - 480Y/277 volts
Frequency - 60 cycles
Service - 3 phase, 4 wire, ampere capacity as indicated on drawings.
Neutral - full capacity
Available short circuit current at line terminals - 65,000 RMS amperes symmetrical.
Integrated equipment rating - 65,000 AIC
Copper ground bus, full length
UL service entrance label

2.13 PANELBOARDS

A. Panelboards shall be dead-front, door in door safety type equipped with single or multi-pole circuit breakers suitable for 120/208 volt or 277/480 volt, 3 phase, 4 wire operation.

B. Buses shall be copper. Panelboards shall have a circuit directory card mounted in a frame with plastic cover on inside of door. Panelboards to have a copper ground bus with terminals for each circuit. Panelboards serving isolated ground receptacles shall have a separate ground bus for terminations of the isolated grounds. The isolated ground bus shall be mounted to the panel tub via non-conducting means with a separate grounding conductor run to the normal panel ground bus.

C. Panelboards and distribution panels shall be of same manufacturer as switchboard.

2.14 DRY-TYPE TRANSFORMERS

A. Dry-type transformers shall be 480 volt, 3 phase, delta connected primary and 120/208 volt, 3 phase, 4 wire wye connected secondary with grounded neutral. They shall be of the KVA size, voltage rating, and characteristics as shown on the drawings. Transformers 75KVA and larger shall have minimum impedance of 4-1/2%. Transformers feeding panels with surge suppressors shall be K-13 rated.

B. Provide grounding of separately derived systems in accordance with Code Article 250.

C. Transformers shall be of same manufacturer as switchboard.

2.15 ELECTRIC SERVICE

A. Coordinate and cooperate with Utility Co., with respect to providing service and metering. See allowances section for backcharges by utility company with respect to permanent service.

B. Provide all primary system raceways, elbows, pull wires and all pad grounding. Utility company will provide pad mounted transformer and primary conductors including making up of all terminations and connections.

C. Provide secondary service complete including conductors and raceways.

D. Metering: All usage will be on one secondary meter. Utility Company will furnish current transformers and potential transformers to be installed in switchboard by contractor. Empty raceway with pull wire from the C/T compartment to the meter backboard shall be provided.

2.16 TELEPHONE/DATA SYSTEMS

A. Telephone system instruments and interconnecting wiring will be provided by the ITS Contractor. Data system outlets and interconnecting wiring will be provided by the ITS Contractor.

B. For each telephone outlet or data outlet indicated on the drawings, provide a 4” square flush outlet box. In insulated partitions, provide a 1" raceway stubup terminating with bushing to above nearest accessible hung ceiling.

2.17 STANDBY ELECTRICAL SYSTEM

A. Provide one 75KW, 93.75 KVA at .8 PF standby power diesel generator set mounted in perfect alignment on an all welded, fabricated steel sub-base which shall allow for attachment of all necessary engine and generator accessories.

Acceptable Manufacturers:

Caterpillar
Onan
Kohler
Generac
Baldor

B. Generator: 75 KW, 93.75 KVA, 277/480 volt, 3 phase, 4 wire, 60 Hz, 1800 RPM revolving field type main generator with brushless exciter.
Voltage regulation $\pm$1%.

C. Generator Control Panel:

1. To completely control operation of engine generator set. Panel to have automatic start control, AC volt meter, AC ammeter, pointer type frequency meter, volt meter, ammeter and selector switch.

D. Automatic Transfer Switch:

1. Provide automatic transfer switches for operation on 277/480 volts, 3 phase, 4 wire operation. Unit to be housed in a NEMA 1 enclosure.

   Entire switch shall be listed under UL 1008.

Acceptable Manufacturers:

Russ Electric RMTD (4 Pole)
ASCO (with overlapping neutral contacts)
Onan
Kohler

E. Remote Annunciator Panel: A flush mounted panel shall include a visual signal that battery charger is functioning properly and both audible and visual signals. Annunciator shall meet NFPA 110 Standards.

F. Generator shall be housed in a weatherproof sound attenuated aluminum enclosure.

G. Reuse the existing 160 kw diesel generator and transfer switch for optional standby loads.

2.18 FIRE ALARM AND DETECTION SYSTEM

A. Work Included:

1. Furnish and install a 24 VDC closed circuit non-code, continuous ringing, supervised, addressable fire alarm system in accordance with the following specifications, to be wired, connected and left in first class operating condition. All equipment shall be listed by Underwriters Laboratories or approved by Factory Mutual.

2. General Requirements

a. The system shall include but not be limited to all control panels, power supplies, initiating devices, audible (Voice Evac) and visual alarm devices, and all accessories required to provide a complete operating fire alarm system in accordance with code and local fire department.

2.19 SURGE PROTECTIVE DEVICES

A. Furnish and install surge protective devices with ratings of 120,000 amperes on the secondary side of the main service overcurrent device and panelboards feeding computer equipment.

2.20 PANELBOARD LIGHTING CONTROL SYSTEM

A. Panelboard Lighting Control System

1. The lighting control system shall consist of microprocessor-based control electronics with remotely operated circuit breakers. The circuit breakers shall provide overcurrent protection, and have an AIR rating or series connected rating that meets or exceeds the fault current of the system to which the panelboard is being applied. Each lighting control panel to have a built-in CPU.

2. The lighting control system shall meet or exceed the following capabilities:

a. Sixteen (16) 2-wire maintained dry-contact inputs for connection to external low voltage (24 Vdc or below) switch contacts.
b. Zone creation of multiple branch circuits and control of zones.
c. Individual zone override.
d. True status feedback by monitoring branch circuit breaker status based on actual system voltage at load side terminal.
e. Downloadable firmware over network that will permit field installation of newest features in existing systems.

2.21 LADDER TRAY

A. Provide 12" wide aluminum ladder tray with 9" rung spacing with 6" side rail. Ladder tray shall be as manufactured by B-Line. “Ladder Type”. Provide all hangers required.

2.22 CLOSED CIRCUIT TELEVISION (CCTV)

A. Provide a complete UL Listed CCTV system as shown on drawings and herein specified. All system components shall be from a single manufacturer.

B. Cameras: Camera installations shall be securely attached to mounting surface.

C. The Closed Circuit TV System shall consist of computer servers with image software, computer monitors and IP based closed circuit TV cameras. The head end server will be located in the head end MDF room and will be rack mounted. The system will be accessed from any PC within the facility or externally via an IP address. Each camera can be viewed independently. The network video recorders NVR’s will record all cameras and store information for 21 days at 15 images per second (virtual real time).

D. The location of the cameras is generally in corridors and exterior building perimeter. The exterior cameras will pan-tilt-zone type.

E. Cameras shall be solid state and have automatic iris control and shall be for interior or exterior use under normal and low light conditions of illumination and shall be provided with a weatherproof or tamper-proof housing as specified.

F. Weatherproof-tamper proof housing for fixed cameras shall be constructed of aluminum and finished with a weatherproof, heat reflecting paint. Housing shall be internally insulated. Hinged cover shall be secured in place with tamper proof bolts.

G. Interface system with card access, intrusion and intercom systems. Activation of system alarms shall call up the appropriate camera. Activation of a door intercom station shall also call up the appropriate camera.

2.23 SECURITY SYSTEM

A. Furnish a complete addressable Security and Detection and Alerting system to be connected, tested and left in first-class operating condition.

B. The security alarm system shall monitor the integrity of all alarm initiating circuits.

C. System Operation:

1. The system shall be completely addressable. System shall be continually supervised by a microprocessor.
2. The system shall be armed, disarmed, reset, monitored and altered by the use of the remote multiplexed type alpha numeric keypads. The system shall be capable of arming or disarming by zone/partition.
3. Actuation of any device shall cause the following to occur.

- Activate telephone dialer, seize the protected premises telephone line and automatically report the alarm to a remote location.
- Indicate the alarm condition at the remote keypad.
- Record device alarm on the access control computer and activate the sound system for alarm tones over the entire PA System.

- Call up the closed circuit camera in the area and record at 30 frames per second.

D. Provide equipment of Detection Systems, Inc. or equal.

2.24 DUAL TECHNOLOGY CEILING OCCUPANCY SENSORS

A. Dual technology occupancy sensors shall be capable of detecting occupants within the coverage area designated via detection of a doppler shift in the transmitted ultrasonic sound wave and a change in the infrared heat present. Major motion and minor motion shall cause the controlled load to switch to the “ON” mode.

B. The dual technology passive infrared sensor shall use a multi-level 100 segment Fresnel lens and four pyroelectric detectors to insure adequate PIR coverage of the intended area.

C. Dual technology sensors shall have on override to “ON” bypass logic key in the event of sensor failure.

D. Sensors are to be ceiling mounted using a back mounting plate and standard electrical outlet boxes.

E. Dual technology sensors shall cover up to 2000 sq. ft. for walking motion, with a field of view of 360 degrees.

F. Dual technology sensors shall be compatible with electronic ballasts, compact fluorescent, and inductive loads.

2.25 CARD ACCESS

A. Furnish and install a complete access control system as specified herein and shown on the drawings. The system shall include a head end computer with 17” monitor, keyboard, mouse and printer. Furnish and install S2 controllers with 4 hour battery backup.

B. Controller: Unit shall be able to accept 16 doors complete with card reader request to exit and door position switch. Controllers shall provide 400 event buffer.

C. Card Readers: Furnish and install proximity readers as shown on drawings. Devices shall have a 6” – 10” read range. Devices shall be flush mounted.

D. Cards: Provide 250 proximity cards. Cards shall be the size of a standard credit card in both thickness and dimension.

E. Interface the access control system with the closed circuit TV system for alarm call up and allow for CCTV images to be viewed from the access control computer. Interface system with the intrusion alarm system to annunciate alarms (by device) on the access control computer. All intrusion alarms shall be recorded on the access computer and printed on system printer.

2.26 LIGHTNING PREVENTOR SYSTEM

A. Provide all labor, material, equipment, and services to perform all operations required for the complete installation and related work as specified herein and indicated on drawings for the early Streamer Emission System.

Any such work included in any other section of these specifications that is not specifically described therein shall comply with the requirements of this section.

The following items of work are specifically included in, but not necessarily limited to, the work of this section without limiting the generality implied by these specifications:

1. ESE lightning protection air terminal
2. Mast, complete with base and supports
3. Down conductors
4. Grounds
5. Surge Protective Devices

B. Submittals

1. Provide shop drawings showing location of ESE air terminal, mast conductors, installation procedures and details. Detailed manufacturer's data sheets on all components, accessories and miscellaneous equipment to be used in the installation shall also be submitted.
2. One complete set of independent performance testing documents on the ESE air terminal system shall be submitted to show compliance with the protection area of the unit submitted for the installation.

C. Description of System

1. The ESE installer shall provide a complete installation of equipment to comprise a complete system against damage by lightning. The ESE installer shall be responsible for all material and labor to accomplish this result.
2. The system, including the ESE air terminal, conductors, mast and complementary parts, shall be installed so that completed work is unobtrusive and does not detract from the building appearance.

D. Codes, Regulations, Permits

1. The completed system shall comply with the ESE manufacturer’s standard, equipment supplier drawings and specification requirements for installation of ESE lightning protection systems.

E. Standards of Quality

1. The ESE system equipment supplier, contractor, and installer shall install the ESE system in compliance with the ESE Manufacturer’s Standard.
2. The ESE system and manufacturer’s guarantees and warranties shall be submitted to the owner upon completion of the ESE system installation.

F. Service and Testing

1. Installation of equipment shall be done under the direct supervision of a manufacturer and per the manufacturer’s requirements.
2. The lightning protection installing contractor shall provide photos and/or video of the installation, including but not limited to, mast mounting, bonding connections (waterline & structural steel), down conductors, ground rods/grids and all buried, concealed or inaccessible connections and components. This information shall be forwarded to the ESE manufacturer for evaluation, certification, archiving and documentation.
3. The ground resistance of the completed system shall be measured using IEEE "Fall of Potential Method" in the presence of the Architect/Engineer and shall be forwarded to the ESE manufacturer. Ground resistance shall be ten (10) Ohms or less.

G. ESE Air Terminal

1. The complete assembly shall consist of: 5/8” air terminal which is HD 29 CU and heavy chrome plated 24 CH; lock nut and washer of chrome plated copper; support structure of chrome plated soft copper; and sphere shall be threaded to air terminal. The base of the ESE air terminal shall be threaded for interconnection to top of mast.

H. Conductors

1. Copper conductors shall be 28 strands of 14-gauge wire rope lay, with a net weight of 375 pounds per 1,000 feet (60mm2), minimum.
2. The structural steel may be utilized as main conductor if the steel is electrically continuous or is made so via other means. Every other column or an average of 60’-0” (18m) intervals shall be bonded and connected to the ground system.
3. All conductors shall be secured every 3'-0" (900mm) maximum. Fasteners and clips utilized shall be of equal corrosion resistance as the material being secured.
4. Bonding of all conductive material within 6’-0” (1800mm) of the conductor shall be accomplished via secondary conductor no smaller than #6 (14mm2) copper.
5. Bare copper material shall not be installed on dissimilar metals.
6. Corrosion resistant copper or bronze equipment shall be utilized where these conditions exist. Corrosion resistant copper conductors and fittings shall be utilized where corrosive atmospheres are present.
7. Conductors shall be installed so that a conductor shall always have a horizontal or downward path, free of "U" and "V” pockets, with the exception that an 8” (203mm) maximum rise or a rise of 3” (80mm) maximum for every 12” (300mm) of conductor length shall be permitted in a main conductor run.
8. Each ESE terminal shall have two (2) paths to ground from the base plate of the mast, with the exception of an elevated mast that may have a single conductor run for a maximum of 16’-0” (4880mm) before two (2) down conductors shall be initiated.
9. The electrical contractor shall furnish and install all necessary PVC conduit for concealed down conductors.
10. No bend of a conductor shall be less than ninety (90) degrees and shall not have a radius of bend of less than 8” (203mm). Exceptions are through roof and wall assemblies and "T" connections.

I. Mast

1. Aluminum or galvanized steel mast, height to be determined by the area of protection, with threaded connection for the ESE air terminal and bonding plate for cable connection. Wind and safety factors shall be documented for the geographic area of installation, to determine the size and structure of mast.
2. Base support, depending upon application, flat mounting base, side mounting base and/or structural support, and/or flag- pole may be utilized.

J. Grounding System

1. Ground rods shall be copperclad 3/4" (20mm) x 10' (3000mm), minimum. One set of tripod grounds shall be installed for each down conductor [two (2) minimum per system; refer to paragraph C, for structural steel used as down conductors, grounding requirements]. Ground plates of high conductivity copper sheet, 20 gauge minimum, 18 in. sq. 460mmsq. [three (3) required per down conductor], may be used in lieu of or in combination with ground rods to achieve the ten (10) ohm resistance grounding system requirement. The cable attachments to the ground rods must be accomplished via exothermic welds or mechanical clamp. Cable attachments to the ground plates shall be via cast bronze bond plates of eight 8in2 (5161mm2) of contact area.
2. A ground loop may be substituted for the ground rods or ground plates. The ground loop must be of a main size conductor and shall comply with the ten (10) Ohm resistance requirement of the grounding system.
3. Ground rods, ground plates, and ground loop conductors shall be installed a minimum of 1ft. (300mm) below grade and a minimum of 2ft. (600mm) away from the foundation. All grounding locations shall be as evenly spaced around the building perimeter as possible.
4. A minimum of one (1) inspection well, rated for the traffic of the installation area, shall be installed for each down conductor or two (2) minimum per ground loop.
5. Bonding of grounded systems shall be via main size conductors. The bonding shall be accomplished to achieve equal potential of all grounds. All underground connections shall be via exothermic welds, where possible.

K. Connectors, Fittings, Fasteners, and Hardware

1. Provide all connectors, fittings, fasteners, hardware, clamps, guards, lugs, exothermic welds, etc., as required to connect, and install all parts of the system. All equipment shall be fabricated from copper and/or bronze material.

L. Installation-General

1. Installation shall be accomplished in a professional manner by an installer of verifiable ESE system installation.
2. All work installed within the building shall be concealed.
3. All work installed in accessible locations shall be properly guarded and protected.
4. All material shall be installed in a manner to prevent electrolytic action under presence of moisture.
5. All roof, wall or other building penetrations shall be made in a manner to prevent the ingress of water or moisture. Roof penetrations shall be furnished and installed by the roofing contractor.
6. PVC sleeves shall be provided where conductors pass through all floors; furnished and installed by others.

M. Manufacturer

1. The Lightning Preventor System shall be manufactured by Lightning Preventor of America, Inc., Model No. 2005 or approved equal (Protected Radius, 328 ft.), telephone number 800 421-6141.

2.27 STAGE LIGHTING AND DIMMING SYSTEM

A. Provide all labor, material, equipment and services for a full dimming system for the auditorium including theatrical lighting. System shall include dimming racks, control console, connector strips, emergency transfer cabinet, light fixtures, etc.

B. The system shall be equal to Electronic Theatre Controls “ETC” or equal.

PART 3 - EXECUTION

3.1 WORK COORDINATION AND JOB OPERATIONS

A. Equipment shall not be installed in congested and possible problem areas without first coordinating installation of same with other trades. Relocate electrical equipment installed in congested or problem areas should it interfere with the proper installation of equipment to be installed by other trades.

3.2 PLANS AND SPECIFICATIONS

A. Plans:

1. Drawings showing layout of electrical systems indicate approximate location of raceways outlets and apparatus. Runs of feeders and branch circuits are schematic and are not intended to show exact routing. Final determination as to routing shall be governed by structural conditions and other obstructions.

B. Specifications:

1. Specifications supplement drawings and provide specifics pertaining to methods and material to be used.

3.3 IDENTIFICATION

A. Equipment shall be marked for ease of identification as follows.

1. Provide screw-on nameplates on switchboards, panelboards, F.A. terminal cabinets, starters, and disconnect switches. Nameplates to be of black phenolic with white engraving. For starters and disconnect switches lettering shall be minimum of 1/4" high.
2. Space neatly typed directory cards listing circuit designations shall be fastened inside the cover of panelboards. Spare circuits shall be penciled.
3. Wiring device plates on devices connected to normal-emergency circuits shall be red in color.
4. All conductors in boxes larger than standard outlet boxes, in all wireways, trench headers, etc. shall be grouped logically and be identified.
5. Grounding conductors and neutrals shall be labeled in panels, wireways, etc. as to circuits associated with.

3.4 PROTECTION AND CLEANUP

A. Protection:

1. Materials and equipment shall be suitably stored and protected from weather.

3.5 PORTABLE OR DETACHABLE PARTS

A. Retain possession of and be responsible for spare parts, portable and detachable parts, and other removable portions of installation including fuses, keys, locks, blocking clips, inserts, lamps, instructions, drawings, and other devices or materials that are relative to and necessary for proper operation and maintenance of the system until final acceptance, at which time such parts shall be installed or turned over to the Owner, as the case may be.

3.6 SAFETY PRECAUTIONS

A. Provide proper guards, signage, and other necessary construction required for prevention of accidents and to insure safety of life and property. Remove any temporary safety precautions at completion.

3.7 MOUNTING HEIGHTS

A. All electrical equipment shall be mounted at the following heights unless noted or detailed otherwise on drawings. Notes on architectural drawings shall supersede those noted below or detailed on the electrical drawings. If mounting height of an electrical component is questionable, obtain clarification from Architect before installation.

1. Duplex convenience outlets, microphone outlets, and telephone outlets - 18 inches.
2. Light switches, pushbutton stations, HOA switches, and all other toggle or control switches for the operation of heating, ventilating, and air conditioning, plumbing, and general service - 48 inches.
3. Clock outlets - 84 inches.
4. Fire alarm pullstations - 48 inches.
5. Fire alarm audio visual signals - 80 inches or 6 inches below ceiling, whichever is lower.
6. Panelboards for lighting, power, telephone, and other auxiliary systems - 78" to top.

B. Mounting heights given are from finished floor to centerline. In the case of a raised floor, surface of raised floor is the finished floor.

3.8 WORKMANSHIP AND INSTALLATION METHODS

A. Fastenings:

1. Fasten electric work to building structure in accordance with the best industry practice.

B. General Raceway Installation:

1. Install the various types of raceways in permitted locations as previously specified. All raceways shall be run concealed. Consult Architect for instruction for raceways which must be exposed in public spaces.

3.9 BRANCH CIRCUITS

A. Provide all branch circuit wiring and outlets for a complete and operating system. The system shall consist of insulated conductors connected to the panelboards and run in raceways or as cable systems if permitted under products section, as required to the final outlet and shall include outlet boxes, supports, fittings, receptacles, plates, fuses, etc.

3.10 FIREPROOFING AND WATERPROOFING

A. Fireproof and waterproof all openings in slabs and walls to maintain the original rating of same.

3.11 CUTTING AND PATCHING

A. All cutting of surfaces, including core drilling of walls and slabs, shall be done by Electrical Subcontractor. Openings through new wall surfaces will be provided by General Contractor if Electrical Subcontractor gives suitable notice as erection of surface proceeds. If suitable notice is not given, Electrical Subcontractor shall then be responsible for cost of corrective work required.

3.12 MECHANICAL SYSTEM COORDINATION

A. The Mechanical System Subcontractor will be providing various items of mechanical services equipment and control apparatus. In general, Electrical Subcontractor shall connect up power wiring to this equipment. Equipment provided by Mechanical System Subcontractors will include built-in disconnecting means and overcurrent protection unless shown otherwise on drawings. This does not include terminal boxes.

3.13 DISTRIBUTION EQUIPMENT TESTING

A. All dry-type transformers, individual motor starters, switchboard and main distribution panels, motor controls, motor control centers, feeder conductors, and emergency systems shall be tested in accordance with the following. In general, all tests shall be done in accordance with the 1995 Acceptance Testing Specifications of the International Electrical Testing Association.

B. Grounding Grids or Electrodes: Measurement of resistance from ground grids or electrodes to earth to determine adequacy of grounding system in building and compliance with specifications and/or electrical code.

C. Settings of Adjustable Devices: Using the result of the fault current and coordination study specified hereinafter, the Testing Contractor shall set all adjustable devices.

3.14 WORK IN EXISTING BUILDING

A. The existing building is occupied and will continue to be so during construction. The electrical work shall be done so as to not disrupt the Owner’s existing operations.

B. Any shutdowns of electricity shall be coordinated with the General Contractor's and Owner's representatives at least 48 hours in advance. Shutdowns which, in the opinion of the Owner, are of a minor nature not affecting the operation, may be allowed during normal working hours. Other shutdowns will only be allowed on off hours, shall be properly scheduled in advance, and shall not be greater than a 4 hour continuous duration.

C. No existing system shall be left inoperable at any time, except for short periods during normal working hours.

D. Any new work required to pass through occupied areas shall be done at other than normal working hours.

E. No energized exposed conductors will be allowed to remain unattended where accessible to the public or the Owner's staff. The Electrical Subcontractor shall be completely responsible for protection and guarding the electrical system during the work so as not to create a hazard.

F. Comply with the Owner's requirements concerning work rules in existing buildings, especially with respect to noise, drilling and cutting, etc.

END OF SECTION

SECTION 27 00 00

TECHNOLOGY

PART 1 - GENERAL

1.1 TIME, MANNER AND REQUIREMENTS FOR FILING SUB-SUB-BIDS

A. FILED SUB-SUB-BID REQUIRING A PARAGRAPH “E” LISTING on the FORM FOR SUB-BID required per M.G.L. Chapter 149 Section 44A to 44L, as amended to date. The Electrical Subcontractor shall be responsible for all related building preparation and coordination as required, see specification for additional Paragraph “E” Listing requirements of the Listed Systems Contractor, and coordination of responsibilities.

B. It is the sole intent of this Paragraph “E” Listing to ensure to the end-user, a Fully Functional Technology System.

C. This Section shall be provided by a qualified Systems Contractor.

1. The Systems Contractor shall be DCAM Certified by the state of Massachusetts Division of Capital Asset Management, in the category of: TELECOMMUNICATION SYSTEMS.

D. Section 27 00 00 Technology shall be a Filed Sub-Sub Bid of Section 26 00 00 ELECTRICAL, requiring a Paragraph “E” Listing on the FORM FOR SUB-BID

1.2 GENERAL PROVISIONS

A. Attention is directed to the contract and general conditions and all sections within Division 1 General Requirements, which are hereby made a part of this section of the specifications.

B. Examine all other sections of the specifications for requirements affect work of this section whether or not such work is specifically mentioned in this section.

C. Coordinate work with that of all other trades affecting, or affected by work of this section. Cooperate with such trades to assure the steady progress of all work under the contract.

D. This Section shall be provided by a qualified Systems Contractor.

1. Provide and install sound, voice, video & data infrastructure and equipment as specified. The General Contractor shall be solely responsible for coordinating the work of the Systems Integrator. The Electrical Subcontractor shall also be responsible for coordinating its work with the work of the Systems Integrator.

1.3 COOPERATION AND COORDINATION WITH OTHER TRADES

A. The work shall be so performed that the progress of the entire building construction, including all other trades, shall not be delayed and not interfered with. Materials and apparatus shall be installed as fast as conditions of the building will permit and must be installed promptly when and as directed.

1.4 TELEPHONE/DATA SYSTEM

A. General:

1. All telecommunication and data system interconnecting wiring, terminal blocks, connections, terminations, shall be furnished and installed by a licensed and certified installer.
2. The Electrical Subcontractor (E.C.) shall furnish and install all raceways, and outlet boxes as indicated on the drawings, including pull wires for all empty raceways and all access panels. General contractor will furnish and install all backboards (3/4" thick by 78" high) which shall be mounted at the MDF room and each IDF room.

1.5 DEFINITIONS

A. Main Cross Connect (MC): The MC is the location, within a building or complex of buildings, where the entire telecommunications system originates. It may include: the physical location, enclosure, wire and cable management hardware, termination hardware, distribution hardware, and patching and equipment racks.

B. Horizontal Cross Connect (HC): The HC is the location in a building where a transition between the backbone or vertical riser system and the horizontal distribution system occurs.

1.6 SYSTEM DESCRIPTION

A. The data communications system shall consist of four components, active switch equipment, an optical fiber backbone, a copper twisted-pair backbone, and twisted pair copper work station cabling.

1.7 SCOPE OF WORK

A. The work under this Section includes providing of all material, labor, equipment and supplies and the performance of all operations to provide a complete working Integrated Instructional Technology Network System as required by the Drawings and details and as specified herein. Where the Drawings, Specifications, Codes, Regulations, Laws, or the requirements of the local Authority conflict, provide the higher quality and higher quantity indicated or required and follow the strictest requirement. In general, the work includes, but is not limited to, the following:

1. Cabling for Sound and Clock per manufacturers requirements.
2. Equipment Racks and Cabinets.
3. Protection of new and existing work.
4. Record Drawings and Documentation.
5. Operation and Maintenance Instructions and Manuals for the Section's work.
6. Nameplates, Labels and Tags.
7. Testing and certification.
8. Sound, Public Address, Master Clock.
9. Gymnasium, Cafetorium, Local Sound Systems.

1.8 PROTECTION OF WORK AND PROPERTY

A. Be responsible for the care and protection of all work included under this Section until it has been tested and accepted.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interface work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.10 WARRANTY

A. Provide one (1) year Warranty under provisions of Section 017000 - CONTRACT CLOSEOUT. Warranty shall include all materials, equipment and work furnished or installed under this Section. Any failure due to defective material, equipment, installation or workmanship which may develop shall be corrected at no expense to the Owner including all materials, labor, travel, expenses, system diagnostics and damage to areas, materials and other systems resulting from such failures.

1.11 MAINTENANCE

A. Provide installers maintenance contract quote, upon request, for a period equal to warranty.

1.12 SEISMIC REQUIREMENTS

A. Equipment and work shall meet the restraint requirements for a Seismic Zone - 2 location including installation and connections of material and equipment to the building structure.

1.13 FUNCTION AND OPERATION

A. The intended function of the data communications cable system is to transmit data signals from a central location to several individual data outlet locations. Upon completion of the work outlined in this specification, the system shall be capable of transmitting data signals at a rate of 1000 Mbps.

PART 2 - PRODUCTS

2.1 GENERAL

A. Throughout Part 2, material quantities are given. These quantities are given for reference purposes only. It is the responsibility of the Contractor to provide appropriate quantities of materials to provide a complete, functional system.

2.2 FIBER INNERDUCT

A. DESCRIPTION: From the MDF to IDF, segments of optical fiber innerduct shall be installed.

1. Quantities Required: Innerduct runs do not have to be continuous throughout, breaks are expected at the pull boxes. Contractor is responsible for determination of actual lengths of innerduct required. Enough innerduct shall be provided and installed to extend from the fiber service loop in the MDF to the fiber service loop in each IDF. If the route passes through a pull box, the segments of innerduct shall extend twelve inches into the pull box. If the route passes through an enroute HC, each segment of innerduct shall extend at least twelve inches beyond the end of the service conduit.

2.3 FIBER DISTRIBUTION

A. DESCRIPTION: From the MDF to each IDF a continuous segment of fiber cable shall be provided.

1. Product: 12 strands multi-mode 50/125 UM and 6 strands single-mode 8.3/125 UM.
2. Quantities Required: The contractor is responsible for determination of actual segment lengths. Actual quantities will be determined by the routing established by the electrical engineer.

2.4 WORK STATION CABLE

A. DESCRIPTION: From each MDF or IDF, 4-pair enhanced Category 6 cables shall be routed to each work station (data outlets). Category 6A shall be provided as indicated on drawings.

2.5 INTERMEDIATE DISTRIBUTION FACILITIES

A. DESCRIPTION:

1. Products and Quantities:

a. Equipment Rack: Panduit CMR19x84, 19 X 84", floor-mounted.
b. Fiber Interconnect: Panduit FRME2, 12 Port Rack Mount Fiber Patch Panel.
c. Modular Patch Panels: Panduit DP48688TG, 48-port Category 6 Patch Panel. One (1) Port for each workstation served from the MC with a minimum of 12 spare ports are required. If the number of workstation cables, plus required spare count (12) is greater than 48, then a second 48 port patch panel is required.

2.6 TESTING AND DOCUMENTATION

A. TESTING: Contractor shall test each fiber strand and each pair of each twisted-pair copper cable. The Owner reserves the right to have a representative present during all or a portion of the testing process. If the Owner elects to be present during testing, test results will only be acceptable when conducted in the presence of the Owner.

B. DOCUMENTATION: Contractor shall provide documentation to include test results and as-built drawings.

1. Fiber Test Results: The results of the fiber testing shall be entered into the attached form "10 Fiber Attenuation Test Results". Hand written results are acceptable provided the text is neat and legible. Copies of test results are not acceptable. Only original signed copies will be acceptable.
2. Work Station Cable: The results of the work station cable tests shall be provided in the form of print-outs from the test equipment.

2.7 INTEGRATED SOUND, PUBLIC ADDRESS, & WIRELESS MASTER CLOCK SYSTEM

A. General:

1. Provide all equipment, accessories, and materials in accordance with these specifications and related documents to provide a complete and operating Integrated, Sound, Intercom and Master Clock System.

B. System Description:

1. This Section includes requirements for programmable Integrated and Video System components including, but not limited to, the following:

Integrated Communications System Computer and Software.
Telephone System Integration Requirements.
Controls, Amplifiers, and Terminal Equipment.
Power Supplies.
Battery Backup for System Programming.
Accessories.
Wireless Master and Secondary Clock Systems

PART 3 - EXECUTION

3.1 GENERAL

A. Do not install equipment and materials which have not been reviewed by the Architect. Equipment and materials which are installed without the Architect's review or without complying to comments issued with the review shall be removed from the project when so instructed by the Architect. No payment will be made for unapproved or removal if it is ordered removed. The Installer shall be responsible for any ancillary costs incurred because of its removal and the installation of the correct equipment and materials.

3.2 EQUIPMENT RACKS, CABINETS AND BRACKETS

A. Securely mount equipment racks, cabinets and wall mounted relay brackets to the building structure. Proper supports such as 3/8" lag screws and expansion anchors shall be used. Proper quantity of supports shall be utilized. Dry wall screws and other types of supports not specifically approved to support equipment are specifically prohibited. Submit mounting supports for approval before installation.

3.3 TERMINATIONS

A. All copper conductors of every cable shall be completely terminated at both ends.

3.4 CABLE PATHWAYS

A. Install cables in pathways provided by the Electrical Subcontractor or required under execution part of this Section.

3.5 SEALING OF PENETRATIONS AND OPENINGS

A. Environmental Seals

1. Provide seals on raceways exposed to widely different temperatures, as in refrigerated or cold storage areas. Install seal to prevent circulation of air from warmer to colder sections through the raceway.

3.6 SEISMIC SUPPORTS, SUPPLEMENTARY STEEL AND CHANNELS

A. Provide all supports, supplementary steel and channels required for the proper Seismic installation, mounting and support of all work installed under this Section.

3.7 CABLE SUPPORTS

A. Provide strain relief hardware for backbone cables at each floor level as they pass from one floor to the next.

3.8 CABLE PROTECTION

A. Provide bushings in all metal studs and the like where cables will pass through. Bushings shall be of two (2) piece construction with one piece inserted through the opening and the second piece locking it into place. Single piece bushings with locking tabs or friction fit are specifically prohibited.

3.9 INSTALLATION

A. All cabling shall be installed in conduit where indicated on plans, or shall be installed open using other methods, approved by architect, such as J-Hooks.

1. Install wiring, per manufacturers recommendations. Use UL listed cable in environmental air spaces including ceilings.

3.10 TRAINING

A. As a minimum, training sessions shall consist of the following:

1. General project information and review shall be by the General Foreman or Superintendent of the Trade.

3.11 ACCEPTANCE DEMONSTRATIONS

A. Systems installed under this Section shall be demonstrated to the Owner and Architect. Demonstrations are in addition to necessary testing and training sessions. Notify all parties at least 7 days prior to the scheduled demonstration. Schedule demonstrations, in cooperation with and at times convenient to all parties, so as to not disturb ongoing activities.

3.12 PROJECT OWNER COORDINATION

A. Prior to Substantial Completion of the project and in ample time to address and resolve any coordination issues, request and arrange meetings between the Owner, Owner's Vendors and Consultants, Architect and General Contractor to discuss the Scope of Work for each system being provided and the interface required for a fully functional and operational system upon project completion. Initial meetings shall be scheduled three months prior to the scheduled Substantial Completion date or as soon as Submittals are submitted and reviewed for projects with shorter schedules.

3.13 CLEANING UP

A. Upon completion of all work, and testing, thoroughly inspect all exposed portions of the installation and completely remove all exposed labels, markings, and foreign material.

3.14 PROJECT CLOSEOUT

A. Provide close out submittals as required herein and in SECTION 017700- PROJECT CLOSEOUT including the following close out submittals.

1. Operation and Maintenance Manuals
2. Record Drawings.
3. Test Reports.
4. Extra Materials.

END OF SECTION

SECTION 31 0125

LANDSCAPE MAINTENANCE

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

A Work Included: Provide continuous Landscape Maintenance, complete and as specified during progress of the work, after installation, for Preliminary Review and for the 90 day Maintenance Period. Also included is the Warranty Period Close Out and Final Inspection for Landscape Planting.

1 Refer to Section 32 8100 Irrigation System for the types of irrigation equipment included in the work.

2 Refer to Section 32 9200 Lawns and Grasses for the types of lawns and grasses included in the work.

3 Refer to Section 32 9000 Planting and the Plant list on the drawings for the types of planting included in the work.

B Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.

1 Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

1.03 RELATED WORK

A The following Related Work to be performed under the designated Sections:

1 Existing Plants to Remain - Section 31 1320
2 Irrigation System – Section 32 8100
3 Soil Preparation - Section 32 9113
4 Planting - Section 32 9000
5 Lawns and Grasses - Section 32 9200

1.04 REFERENCES

A "Arboriculture: Care of Trees, Shrubs and Vines in the Landscape" by Richard W. Harris, Prentice-Hall, Inc. 1983.

1.05 SUBMITTALS

A Submit the following in accordance with the provisions of Section 01 3300 – Submittals.

B Materials Submittals

1 Slow Release Fertilizer for Lawns, manufacturer's product analysis and applicable data.

C Quality Control Submittals

1 Schedule of Maintenance Operations and Monthly Status Report: including list of equipment, materials proposed for the job and watering schedule.

2 Licenses, permits and insurance required by Local, the State and Federal government pertaining to maintenance work.

3 Monthly Record: All materials, fertilizers, insecticides and disease control chemicals used for the project. State when used and for what purpose and the rate(s) of application and the time(s) of application.

4 Written application recommendation by a licensed agricultural pest control advisor for all weed, pest and disease controls restricted by the State of Massachusetts proposed for this work.

5 Monthly record of all watering for the project.

D Project Close-out Submittal: Include in a single, 3-ring binder a landscape maintenance manual containing an indexed collection of all schedules, records and permits listed above, as well as a documentation of accepted condition of Planting and Lawns at Final Acceptance. Submit three (3) copies of the manual in accordance with Section 01 7700 – Project Closeout.

1.06 QUALITY ASSURANCE

A Qualifications

1 Experience: The landscape contractor or maintenance subcontractor shall have one of the full-time employees of his assigned to the job as foreman as needed for the duration of the contract. He/she shall have a minimum of four (4) years experience in landscape maintenance supervision, with experience or training in (turf management), entomology, pest control, soils, fertilizers and plant identification.

a There shall be a State registered arborist with at least 5 years experience for all pruning and disease diagnoses.

2 Labor Force: The landscape maintenance labor force shall be thoroughly familiar with, and trained in, the work to be accomplished and shall perform the task in a competent, efficient manner acceptable to the Owner.

B Requirements

1 Supervision: The foreman shall directly supervise the work force at all times. Notify the Landscape Architect of all changes in supervision.

2 Identification: Provide proper identification at all times for landscape maintenance firm's vehicles and labor force. Be uniformly dressed in a manner satisfactory to the Owner.

1.07 PROJECT/SITE CONDITIONS

A Site Visit: At beginning of maintenance period, visit and walk the site with the Owner's representative to clarify scope of work and understand existing project/site conditions.

B Documentation of Conditions: Document general condition of existing trees, shrubs, vines, groundcovers and lawn recording all plant materials which are healthy, thriving, damaged, dead or dying.

1.08 SEQUENCING AND SCHEDULING

A Perform all maintenance during hours mutually agreed upon between Owner and Contractor.

B Work force shall be present at the project site at least once a week and as often as necessary to perform specified maintenance in accordance with the approved maintenance schedule.

1.09 PHASING

A Preliminary Review, Maintenance and Final Acceptance may be divided into a maximum of two (2) phase if approved by the Architect.

1.10 PRELIMINARY REVIEW

A Preliminary Review: As soon as all lawns and plantings are completed per Contract Documents, the Contractor shall request in writing Preliminary Review to determine the condition of the work in the affected Sections listed below:

1 Affected Sections:

a Section - 31 1320 Existing Plants to Remain

b Section – 32 8100 Irrigation System

c Section - 32 9200 Lawns and Grasses

1) Refer to Section 32 9200 – Lawns for grass coverage requirements and other acceptability requirements necessary to attain an acceptable PRELIMINARY REVIEW. PRELIMINARY REVIEW Acceptance initiates the beginning of the 90 day maintenance period (se 1.09).

2) The lawn Warranty Period coincides with the 90 DAY MAINTENANCE PERIOD. (see 1.09.B)

d Section - 32 9000 Planting

2 Within 10 days of the receipt of the written request, the Owner's Representative, the Contractor and the Landscape Architect will review the work completed for conformance to the Contract Documents.

3 Corrective Work:

a Work requiring corrective action or replacement shall be performed within ten (10) calendar days of the review(s).

b Perform corrective work and materials replacement in accordance with the drawings and specifications, and shall be made by the Contractor at no cost to the Owner.

c Continue maintenance of all landscaped areas until such time as all corrective measures have been completed and accepted for Preliminary Review.

4 Pruning: All pruning shall be done during the Preliminary Review unless otherwise required by the Landscape Architect.

1.11 90 DAY MAINTENANCE PERIOD

A Beginning of the 90 Day Maintenance Period

1 The date on which the Landscape Architect issues a letter of Preliminary Review Acceptance to the Contractor shall be the date of the beginning of the 90 Day Maintenance Period.

a If the 90 Day Maintenance Period covers the months of December, January, February, and March, it shall be extended automatically in order that the 90 Day Maintenance Period day count will pick up again April 1, and the tree maintenance and lawn cutting maintenance will be for an actual 90 days of active growth. All other aspects of the 90 Day Maintenance requirements will remain in effect through December, January, February, and March and until the end of the automatically extended 90 Day Maintenance Period at no additional cost to the Owner.

1) All plants not meeting these conditions shall be replaced at this time if within an acceptable planting season, otherwise within the next planting season. A new 90 Day Maintenance Period will be commenced for such plants.

B 90 Day Lawn Warranty

1 Lawns: Section 32 9200 - The Warranty is for the duration of the 90 Day Maintenance Period. The Warranty Ends at acceptance of the 90 Day Maintenance Period. See 32 9200 – 1.08 for acceptance criteria.

C One Year Plant Warranty

1 Refer to Section 32 9000 for specific Warranty requirements.

2 Planting: The One – Year Warranty begins at the acceptance of the 90 Day Maintenance Period and ends at the Acceptance of the Final Acceptance of Landscape Maintenance.

D One Year Irrigation Warranty

1 Refer to Section 02810 - Irrigation Systems for specific Warranty requirements.

2 Irrigation System: Warranty Begins at the acceptance of the 90 Day Maintenance Period and ends at the Acceptance of the Final Acceptance of Landscape Maintenance.

E Maintenance During the 90 Day Maintenance Period:

1 Existing Plants to Remain Maintenance - Section 31 1320

a The Contractor's Maintenance of all Plants and Mulch (In Areas Not to be Disturbed) shall continue until the Date of Final Acceptance of Landscape Maintenance.

2 Irrigation System - Section 32 8100

a The Contractor's Maintenance of all irrigation shall stop at the date of the Landscape Architects letter of Acceptance of the 90 Day Maintenance Period.

b The Owner's maintenance of irrigation shall begin at the date the Landscape Architect issues a letter of Acceptance of the 90 Day Maintenance Period.

3 Lawn and Grasses Maintenance - Section 32 9200

a The Contractor's Maintenance of Lawns stops at the date of the Landscape Architect 's Letter of Acceptance of the 90 Day Maintenance Period.

b The Owner's Maintenance of Lawns shall begin the date the Landscape Architect issues a Letter of Acceptance of the 90 Day Maintenance Period.

4 Plant Maintenance - Section 32 9000

a The Contractor's Maintenance of all plants shall stop at the date of the Landscape Architects letter of Acceptance of the 90 Day Maintenance Period.

b The Owner's maintenance of plants shall begin at the date the Landscape Architect issues a letter of Acceptance of the 90 Day Maintenance Period.

E Acceptance of the 90 Day Maintenance Period

1 The Contractor shall submit a written request to the Landscape Architect for the review for Acceptance at least five (5) working days prior to the anticipated review date, which would be the end of the 90 Day Maintenance Period's Date.

2 Within 10 days of the receipt of the written request, the Owner's Representative, the Contractor and the Landscape Architect will review the work completed for conformance to the Contract documents.

3 Work included in the 90 Day Maintenance will be accepted by the Landscape Architect upon satisfactory completion of the Maintenance Work; however, it will be exclusive of the Final Acceptance of the Irrigation System and Plant Materials which are still under Warranty until Final Acceptance of Landscape Maintenance.

4 Conditions for Acceptance of the Work

a Each plant and the lawn shall be alive and thriving, showing signs of growth and no signs of stress. For additional conditions of acceptance, see the respective sections below:

1) Section 31 1320 - Existing Plants to Remain

2) Section 32 8100 – Irrigation System

3) Section 32 9200 – Lawns and Grasses

4) Section 32 9000 – Planting

5 Replacements

a See the Respective Sections below:

1) Section 31 1320 - Existing Plants to Remain

2) Section 32 8100 – Irrigation System

3) Section 32 9200 – Lawns and Grasses

4) Section 32 9000 – Planting

1.12 ONE YEAR LANDSCAPE PLANTING WARRANTY

A Planting: Warranty begins on the date of the Landscape Architects acceptance of the 90 Day Maintenance Period and ends on the date of the Landscape Architects Final Acceptance for Landscape Planting One Year Warranty.

1.13 FINAL ACCEPTANCE LANDSCAPE PLANTING ONE YEAR WARRANTY

A The Contractor shall request in writing Final Acceptance Review at the end of the Warranty Period for Planting.

1 Within 10 days of the receipt of the written request, the Owner's Representative and the Contractor will review the work completed for conformance to the Contract documents.

2 Landscape Maintenance Manual: Submit binder to Owner during the Final Acceptance Review with all documentation and records required and utilized during the maintenance period.

3 Corrective Work

a Work requiring corrective action or replacement shall be performed within ten (10) calendar days of the review(s).

b Perform corrective work and materials replacement in accordance with the drawings and specifications, and shall be made by the Contractor at no cost to the Owner.

c Continue maintenance of all landscaped areas until such time as all corrective measures have been completed and accepted at Final Acceptance.

B Remove and dispose of all tree stakes, tree guys and tree wrap from all deciduous trees just before Final Acceptance Review.

C Final Acceptance

1 After all necessary replacements and corrective work have been reviewed and accepted by the Owner and if terms of Warranty (as specified in the respective section(s) are complete and acceptable in the judgment of the Owner will issue a written Final Acceptance of the Landscape Maintenance Work specified in this Section.

2 Keys and Identification: Return all keys and identification materials, if any, supplied by the Owner for the purpose of site access.

1.14 DEFINITIONS

A References to Landscape Architect shall mean Architect or the Architect's designated representative.

PART 2 – PRODUCTS

2.01 MATERIALS

A General: All materials and equipment shall be provided by the Contractor, except as specified below.

B Water: Clean, potable and fresh, as available from Owner.

C Fertilizers

1 Refer to Confirmatory Soils Testing and Amending in Section 32 9113 – Soil Preparation for these items.

D Chemicals, Insecticides, and Fungicides for plant disease or pest control

1 If required due to plant disease and pests, only those persons licensed to use these in State where this project is being built shall apply these.

2 Use only those accepted for use by meeting all applicable Local, State and Federal laws and regulations.

3 Best quality materials with original manufacturers' containers, properly labeled with guaranteed analysis.

4 Use non-staining materials.

5 A record of all herbicide applications done, the herbicide used and how much applied shall be kept by the Contractor and submitted at the end of the (1) year Warranty for Plants, Lawns and Meadows.

6 Protect adjacent plant and grasses when herbiciding. Any plants which are killed or damaged in the opinion of the Landscape Architect shall be replaced by the Contractor to match those plants damaged. Remove damaged plant and dispose of legally off site.

E Groundcovers, Perennials and Bulbs: Match accepted materials Nursery-grown in pots, full, healthy plants. Annuals shall be in the same flowering state as those remaining in healthy condition.

F Lawns and Grass Mixes: Match accepted materials.

G Landscape soil (s) and backfill mix(s): Match Accepted Materials for lawns and Grasses and Plants. Refer to Section 32 9113 Soil Preparation.

H Mulch: Match the accepted material. Refer to Section 32 9000 – Planting.

2.02 Replacement Plants and Lawn and Grasses

A Match approved Plants and Lawn and Grass Seed Mix(s).

2.03 EQUIPMENT

A General: Use only the proper tool for each job. Maintain all tools in sharp, properly-functioning condition. Clean and sterilize pruning tools prior to usage.

B Insect/Disease Prevention: Take all measures to prevent introduction of insect or disease-laden materials onto the site. Planting - Section 32 9000.

PART 3 – EXECUTION

3.01 REMOVAL, REPAIR AND REPLACEMENT OF DAMAGED WORK

A Remove, repair and replace any work in Section 31 1320 - Existing Plants to Remain, Section – 32 8100 Irrigation System, Section - 32 9200 - Lawns and Section 32 9000 - Planting or any of the Owner's Existing Property or any Work in the Contract which has been damaged by Maintenance work to match the requirements of the damaged work at no additional cost to the Owner.

3.02 PLANTING MAINTENANCE PREPARATION

A Protection:

1 Protect all new planting areas from damage of all kinds from beginning of work until the Acceptance of the 90 Day Maintenance.

2 Provide temporary protection fences, barriers and signs as required for protection.

B Replacements

1 Immediately treat or replace all plants which become damaged or injured as a result of Contractor's operations or negligence, as directed by Landscape Architect, at no cost to Owner.

2 Replacement plants shall match size, condition and variety of plants replaced.

C Repair any damage done as a result of any maintenance work to Lawns or the Work of any other Section of the Specification to match the work specified therein.

3.03 INSECTS, PESTS, AND DISEASE CONTROL

A Inspection: Inspect all plant materials for signs of stress, damage and potential trouble from the following:

1 Presence of insects, moles, gophers, ground squirrels, snails and slugs in planting areas.

2 Discolored or blotching leaves or needles plant diseases and insect infestation.

a Unusually light green or yellowish green color inconsistent with normal green color of leaves.

B Personnel: Only licensed, qualified, trained personnel shall perform spraying for insect, pest and disease control.

C Application: Spray with extreme care to avoid all hazards to any person or pet in the area or adjacent areas.

3.04 PLANTING MAINTENANCE FOR TREES, SHRUBS AND VINES

A Watering

1 Water shall be applied by the Contractor in sufficient quantities to keep the plants in a healthy thriving condition. Care shall be taken not to over water plants.

2 Watering Basins

a Maintain all watering basins around plants so that enough water can be applied to establish moisture through major root zones.

b For supplemental hand watering of watering basins, use a water wand to break the water force. Do not permit use of "jet" type watering equipment. Do not permit crown roots to become exposed to air through dislodging of soil and mulch.

c Maintain originally called for depth of mulch to reduce evaporation and frequency of watering.

d In rainy season, open basins to allow surface drainage away from the root crown where excess water may accumulate. Restore watering basins at end of rainy season.

3 The Contractor shall review the plant rootballs and adjacent soil(s) and the plants for watering requirements and deficiency or excessive watering symptoms.

a If sufficient water is found to be retained in the plants rootball, and/or adjacent soil, the watering may be reduced.

1) The Contractor shall excavate and examine the rootballs and adjacent soil(s) with an acceptable moisture sensing device designed for this purpose and also make his own professional review and additional sampling and testing as necessary to determine the adequacy of the watering.

b The Contractor shall also review the plants for determination of over or under watering needs and symptoms.

B Resetting: Reset plants to proper grades and upright position using the specified materials.

C Weed Control

1 All areas between plants, including plant beds and watering basins, shall be weed free at all times.

2 Avoid frequent soil cultivation that destroys shallow roots.

D Tree and Shrub Pruning: All persons performing pruning operations shall possess a current Arborist License or be directly supervised by and individual who does for the state in which this project is located.

1 Prune trees and shrubs to select and develop permanent scaffold branches that are smaller in diameter than the trunk or branch to which they are attached. In reference to trees, prune branches that have vertical spacing of 18 in. to 48 in. and radial orientation so as not to overlay onto one another.

2 Prune trees and shrubs to eliminate diseased or damaged growth, and narrow V-shaped branch forks that lack strength. Reduce toppling and wind damage by thinning out crowns.

3 Prune trees and shrubs to maintain growth within space limitations, maintaining a natural appearance and balancing crown with roots.

4 No stripping of lower branches ("raising up") of young trees or shrubs will be permitted.

5 Retain lower branches in a "tipped back" or pinched condition to promote caliper trunk growth (tapered trunk). Do not cut back to fewer than six buds or leaves on such branches. Only cut lower branches flush with the trunk after the tree is able to stand erect without staking or other support.

6 Thin out and shape evergreen trees when necessary to prevent wind and storm damage. Do primary pruning of deciduous trees during the dormant season. Do not permit any pruning of trees prone to excessive "bleeding" during growth season.

7 Prune damaged trees or shrubs or those that constitute health or safety hazards at any time of year as required.

8 Make all cuts clean and close to the trunk, without cutting into the branch collar. "Stubbing" will not be permitted. Cut smaller branches flush with trunk or lateral branch. Make larger cuts (1 in. in diameter or larger) parallel to shoulder rings, with the top edge of the cut at the trunk or lateral branch.

9 Branches too heavy to handle shall be precut in three or more stages to prevent splitting or peeling of bark. Make the first two cuts 18 in. or more from the trunk to remove the branch. Make the third cut at the trunk to remove the resulting stub.

10 Do not prune or clip shrubs into balled or boxed forms unless specifically called for by design.

11 Hedge Pruning – Review plants that are noted in the plant list to be pruned into hedges with the Landscape Architect for shaping requirements.

12 Take extreme care to avoid transmitting disease from one infected plant to another. Properly sterilize pruning tools before going from one infected plant to all other plants.

E Remove all vine stakes and ties at the completion of the warranty period.

F Plant Disease(s)

1 Treat any plants which are diseased.

a If the plants which are diseased do not respond to treatment in the opinion of the Landscape Architect, they shall be removed and replaced with matching healthy plants , at no Additional cost to the Owner.

G Shovel Cut Bed Edging: Redo as necessary to keep shape.

H Remove all dead plants immediately. Replace as soon as possible within the planting season.

I Mulch: Apply mulch as necessary to restore beds to accepted condition.

J Plant fertilization and amending: apply fertilizers and amendments as provided per Confirmatory Soils Testing and Amending in Section – 32 9113 – Soil Preparation.

3.05 GROUNDCOVER'S MAINTENANCE

A Water to maintain the plants in a healthy and flourishing condition.

B Watering

1 Check for moisture penetration throughout the root zone at least twice a month and more frequently as weather conditions require.

2 Water as frequently as necessary to maintain healthy growth of groundcovers.

C Weed Control

1 Control weeds and remove all weeds.

2 Minimize hoeing of weeds in order to avoid plant root damage.

D Fertilization

1 Do not use fertilizers unless soil test shows specific nutrient deficiencies.

a Notify the Landscape Architect of any soil testing need for review and approval prior to testing.

1) Sampling and testing shall be as specified in Section 32 9113 Soil Preparation unless otherwise required by the Landscape Architect.

E Edging

1 Edge groundcovers to keep in bounds. Trim top growth as necessary to achieve an overall even appearance.

2 Shovel Cut Bed Edging: Redo as necessary to keep shape.

F Remove dead plants immediately and replace dead or missing plants as soon as possible within the planting season.

G Plant Disease(s)

1 Treat any plants which are diseased.

a If the plants which are diseased do not respond to treatment in the opinion of the Landscape Architect, they shall be removed and replaced with matching healthy plants , at no Additional cost to the Owner.

H Mulch: Apply mulch as necessary to restore beds to accepted condition.

3.06 LAWN AND GRASSES MAINTENANCE UNTIL ACCEPTANCE OF THE 90 DAY MAINTENANCE PERIOD

A Watering

1 Watering for all lawns and meadows shall be daily for the first week after installation unless site or weather conditions require adjustment of watering or as directed by the Landscape Architect.

2 General Watering: Water lawns and meadows at such frequency as weather conditions require to replenish soil moisture and keep the lawns and Grasses in a flourishing thriving condition (including the period before the irrigation is activated and accepted).

3 Care shall be taken not to over water lawns since adjacent plants or plants in lawn areas might be damaged by over watering.

B Weed Control

1 Control broadleaf weeds and remove.

2 Lawns: Control and remove all crabgrass and weeds and replace and rehydroseed lawn areas within the specified planting season(s).

3 Control thatch buildup of lawns, but not the Meadows or Detention Basin.

C Mowing

1 Hydroseeded Lawns and Athletic Field Cultipactor seeded areas

a The first mowing shall take place when the grass is (4) inches tall and shall result in a height of (3) inches tall.

b Subsequent mowing shall take place when the grass is (4) inches tall. The final cut height shall be no lower than (2-1/2) inches tall.

c Each cutting shall result in a stand of evenly mowed grass. Immediately following cutting, neatly trim around all interfaces such as walls, signs, plant beds etc

1) Do not girdle trees with weed wackers or other trimmers.

d Mowing along Shrub and Groundcover bed edges: Shovel cut or mechanically trim lawn bed edges at least twice a month or as needed for neat appearance. Vacuum clippings and dispose legally off site.

D Fertilization and Amending of Hydroseeded Lawn and Athletic Fields

1 Apply fertilizers and amendments as provided per Confirmatory Soils Testing and Amending in Section 32 9113 – Soil Preparation.

2 Apply fertilizer when grass is dry and preferably after mowing. Do not apply during hot weather or when grass is under stress. Water immediately after application.

E Plant Disease(s)

1 Treat any plants (grasses) which are diseased.

a If the plants which are diseased do not respond to treatment in the opinion of the Landscape Architect, they shall be removed and replaced with matching healthy plants, at no Additional cost to the Owner.

F Replace any damaged, washed out or diseased hydroseeded lawns and Athletic Fields Grass, Meadow Grass, and Detention Basin Grass areas with the specified grasses for the areas.

3.07 MULCH AREAS MAINTENANCE

A Replace any disturbed mulch immediately.

3.08 IRRIGATION SYSTEM

A See Section 32 8100 Irrigation System for any additional requirements.

B Routine: Inspect and adjust all sprinklers and control valves including raising or lowering of sprinkler heights to accommodate plant growth, to achieve uniform irrigation at all times. Verify correct operating pressure.

C Controller: Inspect regularly for power interruption and reset clock as required. Adjust station timing to accommodate changes in plant growth.

D System Failure: Perform all repairs within one (1) operating period. Replacements are to match removed products and materials in all respects. Report promptly all damage not resulting from Contractor's operations. Repair all damage caused by Contractor at no expense to Owner.

E General:

1 Repair without charge to Owner all damages to system caused by Contractor's operations. Perform all repairs within one (1) watering period.

2 Report promptly to Owner all accidental damage not resulting from Contractor's negligence or operations.

3 Do not run the irrigation system during rain. Set and program automatic controllers for seasonal water requirements.

4 Twice a month, use a probe or other acceptable tool to check the rootball moisture of representative plants as well as the surrounding soil.

F Cleaning and Monitoring the System:

1 Continually monitor the irrigation systems to verify that they are functioning properly as designed. Make program adjustments required by changing field conditions.

2 Clean pump filter and strainer at least once a year. Keep the irrigation systems free of sand and other debris as often as necessary.

3 Prevent spraying on walks and walls by balancing the throttle control on the remote control valves and the adjustment screws on the sprinkler heads. Do not allow water to atomize and drift.

G Winterization: The irrigation system is designed to be completely drained in order to protect pipe from bursting prior to freezing temperatures. To adequately drain the system, the following procedure must be followed. See also Section 02810 Irrigation for other requirements:

1 Air blow-out

a Set automatic control stations to 2-1/2 minutes timing.

b Attach hose from portable air compressor to 25mm air inlet installed on main line at backflow preventer.

c Operate compressor at pressure sufficient to blow out all water.

2 Manual drain valves: Open manual drain valves located at low points on the main line to drain main completely after air blow-out has been completed.

3 Backflow Preventer: Rotate backflow unit at unions and open pet cocks and drain. Reverse operation and tighten unions to resume irrigation.

4 For other winterization requirements see Section 32 8100 – Irrigation System.

3.09 CLEAN UP

A Dispose of all pruned materials, vacuum all lawn clippings and leaves, sweep all walkways and rake smooth all mulch areas.

B Remove from the site all containers and evidence of maintenance activities.

END OF SECTION

SECTION 31 1320

EXISTING PLANTS TO REMAIN

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

A Work Included: Provide transplanting, storage, protection, pruning, fertilization, root pruning and other care which may be required of all EXISTING TREES and SHRUBS within the Protection Fence Areas where shown on the Plans and as specified herein.

B Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.

1 Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

1.03 RELATED WORK

A The following Related Work to be performed under the designated Sections:

1 Demolition – Division 02 4100
2 Site Preparation – Section 31 1000
3 Earthwork - Section 31 2000
4 Soil Preparation - Section 32 9113
5 Planting - Section 32 9000
6 Landscape Maintenance - Section 31 0125

1.04 PROJECT CONDITIONS

A Review: Visit and walk the site with the Owner's representative to clarify scope of work and understand project conditions.

B Documentation: Confirm location of all trees within the areas to be protected. Record all discrepancies and all conditions, which threaten existing plantings.

1.05 DEFINITIONS

A Protection: Provide repair to all barricades as required to prevent all damage to existing plant materials to remain, including but not limited to protection from mechanical damage, and soil compaction, pollution from all sources, and disruption of environmental support which would result in the loss of vigor of the Trees and Shrubs

B Protected Area: Areas on the plan protected by Construction Fencing, Silt Fencing, Hay Bales and Protection Fencing.

C Arborists: Person certified and licensed in the State of Massachusetts in the care of plant materials and application of chemicals.

D References to Landscape Architect shall mean Architect or the Architect's designated representative.

1.06 PERIOD OF PERFORMANCE

A From Award of Contract to Final Acceptance For Landscape Planting One Year Warranty. Refer to Section 31 0125 – Landscape Maintenance.

1.07 QUALIFICATIONS

A The Arborist shall be licensed and certified Arborist in the State of Massachusetts with a minimum of (10) years of experience in the care of large trees during the construction process.

1.08 SCHEDULING

A Note that this is a phased project and that work required in this section may need to be installed and maintained out of sequence.

B Construct Protective Barriers and perform other methods as shown on the drawings and as recommended by the Arborist.

1.09 WARRANTY

A Existing Trees and Shrub Warranty:

1 General: Similarly warrant all EXISTING TREES AND SHRUBS which are within the Protected Area, trees to be transplanted and trees to be stored that are part of the work to be protected against decline resulting from damage and or lack of watering during construction until Final Acceptance of the new planting to be installed.

B Damaged or Dead Existing Tree and Transplanted Tree Replacement Tree(s) Warranty

1 The Warranty shall be the same as for new trees and shrubs. See Section 32 9000 Planting

C Exclusions: Damage due to vandalism, Acts of God, or neglect by Owner.

1.10 REPLACEMENT OF DAMAGED EXISTING TREES AND SHRUBS

A Replacement of Existing Trees to be Protected, Transplanted and Stored: Existing trees to be protected, transplanted and stored which exhibit conditions which are determined by the Landscape Architect as unacceptable due to inadequate protection and or watering during construction shall be removed (including stumps and roots), disposed, and replaced and warranted (the same as for new planting) by Contractor at no expense to Owner.

B Replacement trees shall be the same species as the damaged tree.

C Replacement Tree Schedule:

1 Deciduous trees 10" caliper and over: Replace with (1) 9” to 10” cal. B&B specimen trees per damaged tree. The locations and type of tree shall be chosen by the Landscape Architect.

2 Deciduous trees 10" caliper and less: Replace with (1) B&B specimen tree of the same caliper per each damaged tree. The locations and type of tree shall be chosen by the Landscape Architect.

3 Evergreen trees 14’ tall over: Replace with (1) 14’ tall B&B specimen trees per damaged tree. The locations and type of tree shall be chosen by the Landscape Architect.

4 Evergreen trees 14’ and less: Replace with (1) B&B specimen tree of the same height per damaged tree. The locations and type of tree shall be chosen by the Landscape Architect.

5 Memorial Tree: Replace wih (1) B&B specimen tree of same size and species as approved by the Landscape Architect.

D REPLACEMENT SHRUB SCHEDULE

1 Shrubs: Replace with (1) B&B specimen shrub per damaged shrub at the same size as the damaged or dead shrub. The location and species shall be chosen by the Landscape Architect.

E Replacement Trees and Shrubs shall be considered new trees and all applicable requirements as for trees and shrubs are as specified under Planting and all the related sections.

1.11 ACCEPTANCE OF EXISTING PLANTS TO REMAIN AND ANY REPLACEMENT PLANTS

A Acceptance Requirements: For Preliminary Review, 90-Day Maintenance Period, and Final Acceptance, See Section 31 0125 - Landscape Maintenance.

1.12 SUBMITTALS AND SAMPLES

A Submit the following in accordance with the provisions of Section 01 3300 – Submittals.

B Resume of qualified Arborists including a list of similar projects of the licensed and certified Arborist that the Contractor proposes to use on the project.

C Field Report on the condition of the Existing Trees and Shrubs, including means, methods and schedule for care, before Construction begins on the site.

D Submit off site location for stored Memorial Tree.

E Report by the Arborist on the condition and care of the Trees and Shrubs within the project site and the any stored trees.

1 Report Frequency: First week and third week of each month (twice per month) for the months of April, May, June, July, August, September, October and

November. Second week of each month (one per month) for the months of November, December, January and February.

2 Evaluation on the condition of each tree and shrub area.

3 Recommendation for care to be undertaken by the Contractor due to stress, encroachment into the Protected Area by vehicles, foot traffic or stored materials.

4 Recommendations for movement of Protection Fencing and for care for trees and shrub areas in preparation for construction in the area of tree protection.

5 Tree and Shrub evaluation, reports, pruning, fertilization, watering and other means and methods required to be completed by the Contractor during Construction to preserve Existing Trees and Shrubs, shall be provided by the Contractor at no cost to the Owner.

6 Temporary Tree Irrigation:

a Drawing indicating temporary and automatic irrigation system including but not limited to irrigation piping, irrigation heads, timer, pipe connections to the water source and any other equipment necessary to water the trees at intervals recommended by the arborist and/or Landscape Architect.

F Submit (1) pound of pine bark mulch.

PART 2 – PRODUCTS

2.01 FERTILIZERS, HERBICIDES AND PEST CONTROL: As recommended by the Arborists and acceptable to Federal, State and Local authorities.

2.02 PROTECTION FENCING

A Temporary chain link fencing which shall have a 9 gauge mesh and be 6'-0" high above the ground (Salvaged chain link fencing may be used). Line posts shall be 2" o.d. steel pipe. Provide hardware as required for attaching fence. All fabric shall be knuckled selvage.

1 If posts are on paved areas, provide footings which will stabilize fence and not damage paving.

2.03 MULCH:

A Type: Wood chip mulch as recommended by the Arborist.

2.04 TEMPORARY TREE IRRIGATION

A Provide materials acceptable to the Landscape Architect.

2.05 SAFETY: Provide all reflective signage and/or flashers as required by all codes and ordinances affecting protected plantings to remain.

PART 3 – EXECUTION

3.01 PROTECTION FENCE ERECTION

A Install where shown on the Drawings and adjust as needed to accommodate working conditions. Post shall be a maximum of 6’-0” on center.

B Drive posts 3'-0" into ground leaving 6'-0" exposed.

C Stretch and install fabric leaving approximately 1" inch between finish grade and the bottom selvage. Pull fabric taut and tie to posts.

D Maintain the fence in a true, upright and secure alignment

E Remove when directed by the Landscape Architect.

3.02 OPERATIONS

A Storage: Do not store materials or equipment under the branches of all existing trees to remain.

B Traffic: Do not operate nor park equipment within the drip line of existing trees to remain. Keep foot traffic out of existing planted areas.

3.03 TREE TRANSPLANTING

A Dig and Transplant trees that area located on the site and indicated on the plans to the location as indicated on the plans.

1 Tree shall be properly dug with firm, natural balls of soil retaining as many fibrous roots as possible, in sizes and shapes as specified in the *American Standard for Nursery Stock*. Balls shall be firmly wrapped with nonsynthetic, rottable burlap and secured with nails and heavy, nonsynthetic, rottable twine. The root collar shall be apparent at surface of ball. An approved Mechanized Tree Spade may be used. The tree spade shall move trees limited to the maximum size allowed for a similar B&B root-ball diameter according to the *American Standard for Nursery Stock* or the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller. The machine shall be approved by the landscape architect prior to use. Trees shall be planted in accordance with applicable sections of the specifications.

2 Immediately after a tree is dug, it must be replanted where shown on the drawings. Rootballs shall be checked regularly and watered sufficiently to maintain root viability.

B Transportation and Storage of Plant Material

1 Branches shall be tied with rope or twine only, and in such a manner that no damage will occur to the bark or branches.

2 During transportation of plant material, the contractor shall exercise care to prevent injury and drying out of the trees. Should the roots be dried out, large branches broken, balls of earth broken or loosened, or areas of bark torn, the landscape architect may reject the injured tree(s) and order them replaced at no

additional cost to the owner. All loads of plants shall be covered at all times with tarpaulin or canvas. Loads that are not protected will be rejected.

3 Plants must be protected at all times from sun or drying winds.

C Planting: Refer to Planting – Section 32 9000.

D Warranty: The Warranty shall be the same as for new trees and shrubs. See Section 32 9000 Planting

3.04 PROTECTION OF EXISTING TREES, SHRUBS AND STORED TREES

A Protect existing trees and shrubs and other associated vegetation to remain in place, against unnecessary cuttings, breaking or skinning of roots, skinning or bruising of bark, smothering of tree roots by stockpiling construction materials within drip line. Protect vegetation from excess foot traffic, vehicular traffic or parked vehicles within the drip line.

B During construction, all recommendations for care of the Existing Trees and Shrubs to Remain by the Arborist and Approved by the Landscape Architect, shall be performed to assure the health and vigor of the trees at no cost to the Owner.

C Water the trees to be protected as required to maintain their health during the course of construction operations.

D Trees and Shrubs damaged by construction operations which are scheduled to remain.

1 Repair trees and shrubs that are damaged by construction operation in a manner acceptable to the Arborist and Landscape Architect. No roots greater than 2" inches in diameter shall be cut from plants to remain without the prior approval. Provide protection for roots over (1) inch diameter during construction operations by installing a (2) inch layer of mulch.

2 Prune roots that are either cut or broken with a smooth clean cut. Temporarily cover exposed roots with wet burlap to prevent roots from drying out, cover with earth as soon as possible.

3 Replace trees and shrubs damaged beyond repair, as determined by the Landscape Architect. Replacement of trees and removal and disposal of damaged material shall be at the Contractor's expense.

a Refer to REPLACEMENT OF DAMAGED EXISTING TREES as specified in Part 1 of this Section.

4 Trees and shrubs damaged beyond repair as determined by the Landscape Architect shall be removed immediately.

5 Replacement trees and shrubs shall be planted as soon as weather conditions permit and within the specified planting season.

3.05 MULCH LAYER

A Install a (6) inch deep maximum layer of wood chip mulch in areas designated during construction. Remove mulch upon completion of construction and install materials as indicated on the drawings or a (2) inch layer of bark mulch if a material is not indicated on the drawings.

3.06 EXCAVATING AND GRADING IN TREE AND SHRUB PROTECTED AREAS

A Cutting: Do not permit machine excavation within the Protected Area. All such work shall by hand labor unless otherwise authorized by the Landscape Architect.

B Filling: Do not permit stockpiling of soil within the Protected Area.

3.07 REPLACEMENT PLANTS FOR DAMAGED EXISTING PLANTS

A All replacement plants shall be considered new plants and all applicable planting details and specification requirements shall apply.

3.08 MAINTENANCE OF TRANSPLANTED AND PROTECTED TREES

A General: During the Maintenance Period for new planting, similarly maintain all protected trees. See Section 32 9113 - Landscape Maintenance.

1 Add mulch as necessary to replace washed or otherwise depleted mulch areas and as required by the Landscape Architect..

3.09 PRUNING OF EXISTING TREES DESIGNATED TO REMAIN

A In addition to the pruning shown on the drawings, carry out pruning as specified and as directed on site by the Architect, using the crew and equipment specified below for four (4) days of eight (8) hours each on the job site (travel time not included):

1 One (1) foreman (to be a certified arborist).

2 Three (3) laborers.

3 Aerial lift (to 25 foot height).

4 Truck (20 cy capacity).

5 Chipper.

6 Small tools, to include two (2) chainsaws.

B Pruning and trimming are generally described as the removal and disposal of limbs, branches and stubs which are either dead, decayed, diseased, dying, broken, weak, low hanging, rubbing, contacting structures, potentially detrimental to the health of the tree or dangerous to pedestrians, visually deficient, interfering or otherwise objectionable as determined by the Architect.

C This Contractor shall leave the work site at the end of each working period in a condition satisfactory to the Architect. All trimming or any other form of debris shall be removed from the work site and legally disposed by this Contractor, and the areas swept clean of all material related to the work operation.

D This Contractor shall adhere to the specifications and provide suitable facilities for inspecting the work. Failure of the Architect to immediately reject unsatisfactory work or

to notify this Contractor of his deviation from the specification shall not relieve this Contractor of his responsibility to correct or remedy unsatisfactory work.

E All pruning shall be performed in a manner which maintains the natural aesthetic characteristics of the species and varieties of trees. No topping or dehorning of trees or stubbing back of branches shall be permitted. All cuts will be made to a lateral branch a minimum of one third the size of the branch being removed, unless otherwise instructed by the Architect.

F The use of climbing spurs or spike shoes shall not be permitted.

G All cuts shall be made sufficiently close to the parent stem so that wound closure can be readily started under normal conditions. However, cuts shall never be made through the branch collar. Slab cuts and rip cuts shall never be made.

H All pruning performed on this project shall include the provision of proper clearance from all luminaries and proper elevation over street and sidewalk surfaces to at least the following minimum specifications:

1 Luminaries - Any and all branches extending directly below a street luminary as to limit the light reaching the street or path shall be removed and all branches shall be cut back to afford a minimum of four (4) feet of clearance on all sides of all luminaries.

2 Sidewalks/Roads - All branches shall be pruned to allow a minimum eight (8) foot clearance over sidewalk surfaces and ten (10) foot clearance over roadways.

I All limbs over two inches in diameter to be removed shall be pre-cut to prevent splitting. Lower to the ground by proper ropes any branches that would by falling injure the tree and other objects.

J Remove one of the two crossed or rubbing branches, where practical, so that the removal will not leave large holes in the general outline of the tree.

K On trees known to be diseased and where there is known to be danger of transmitting the disease on tools, tools are to be disinfected with alcohol after each cut between trees. Such trees are to be identified prior to pruning for the Architect, who may direct that the tree be removed instead.

L Pruning shall be performed in accordance with the National Arborists Association Pruning Standards for Shade Tree Class II (below). The scope of work shall otherwise be as directed in the field by the Architect.

M Class II - Medium pruning shall consist of the removal of dead, dying, diseased, interfering, objectionable, unsightly, and weak branches on the main trunks as well as those within the leaf area to the full height of affected trees. An occasional branch up to one (1) inch in diameter may remain. The presence of any structural weakness, disease conditions, decayed trunk or branches, split crotches or branches should be reported in writing to the Architect.

N 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 (turkey tailed) will not be permitted.

O The Contractor shall only work on trees designated to remain and to be pruned within the limit of work indicated on the Sitework Drawings, or trees which otherwise affect the work of this Contract. No compensation shall be made for work performed on any other tree.

P If the Contractor discovers tree(s) which have been designated for pruning, but whose condition is such that removal is warranted, whether due to death, disease, decay or structural weakness, such tree(s) shall not be pruned and the Contractor shall immediately report his findings in writing to the Architect before any work is done at such particular tree(s) in question.

3.10 CLEAN UP

A Repair all grades and remove all debris, stumps, plants, trees and shrubs and excess material and legally dispose off site.

B Remove all temporary tree irrigation materials and equipment and legally dispose off site.

END OF SECTION

SECTION 31 2219

FINISH GRADING

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

A Work Included: Execute finish grades complete, as shown on the Drawings, and as specified herein.

B Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.

1 Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

1.03 RELATED WORK

A The following Related Work to be performed under the designated Sections:

1 Electrical – Section 26 0001
2 Earthwork - Section 31 2000
3 Site Concrete - Section 32 1313
4 Unit Paving – Section 32 1400
5 Miscellaneous Site Improvements - Section 32 3000
6 Fencing - Section 32 3100
7 Irrigation System 32 8100
8 Planting - Section 32 9000
9 Soil Preparation - Section 32 9113

1.04 PROJECT/SITE CONDITIONS

A Dust Nuisance: Assume full responsibility for alleviation or prevention of dust as a result of grading work.

1.05 SEQUENCING AND SCHEDULING

A Regrade as required to finish grades and to the satisfaction of the Landscape Architect.

1.06 DEFINITIONS

A References to Landscape Architect shall mean Architect or the Architects designated representative.

PART 2 – PRODUCTS

2.01 EQUIPMENT: At Contractor's option.

PART 3 – EXECUTION

3.01 EXAMINATION

A Verification of Conditions: Verify that the following items have been completed prior to commencement of finish grading:

1 Installation of the topsoil and all soil preparation including debris removal.

2 Incorporation of soil amendments (as required by the Soil Testing Laboratory Report) and as otherwise specified.

3.02 INSTALLATION

A Paved Area Finish Grading

1 Provide finish grading as shown on the Drawings and as specified.

2 All walks must be a maximum of 5%. Any discrepancies shall be brought to the attention of the landscape Architect before the installation of the paving.

3 Cross-slopes including but not limited to walkways, plazas, sidewalks, play surfaces, pedestrian paving, vehicular drop off area and handicap parking areas shall be graded at a maximum of 2 % cross slope. Any discrepancies shall be brought to the attention of the landscape Architect before the installation of the paving.

B Miscellaneous items and materials such as but not limited to area drains, site lighting, walks, walls, curbs, tree grate frames, fencing and gates, and trash receptacles shall relate to the adjacent finish grade surfaces as shown on the drawings and as specified.

C Finish Landscape Grading

1 Provide all grading as shown on the Drawings and as specified.

2 Provide all grades for natural runoff of water without low spots or pockets. Accurately set flow line grades at 2 %minimum gradient unless otherwise noted in Drawings.

3 Finish grade all mulch areas, plant beds, lawn and sod areas by hand raking. Finish grades shall be smooth, even and on a uniform plane with no abrupt changes of surface. Slope uniformly between given spot elevations, unless otherwise shown on drawings.

4 Grades not otherwise indicated shall be uniform levels or slopes between points where elevations are given, or between points established by walks, paving, curbs or catch basins.

5 Tops and toes of all slopes shall be rounded to produce a gradual and natural appearing transition between relatively level areas and slopes.

D Tolerances:

1 As noted in 3.02, A, 2 and 3 of this section.

2 All planting areas, including lawn areas, shall be true to grade within 1 in. when tested with a 5 ft. straightedge.

3 Hold finished grades of Amended topsoil and backfill mixes below top of adjacent pavement, headers, curbs, or walls as follows:

a Trees, Shrub, Annual, Perennial and Groundcover Areas: (1) inch.

b Seeded Lawn Areas: Flush.

c Sodded Lawn: (1) inch.

END OF SECTION

SECTION 312500

SEDIMENTATION AND EROSION CONTROL

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of Specifications.

1.2 DESCRIPTION OF WORK

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

1. The work of the Section consists of all sedimentation and erosion control, and related items as indicated on the Contract Drawings and/or specified herein and includes but is not limited to the following:

a. Silt fence.
b. Hay bale barriers.
c. Temporary covers for drainage structures.
d. Temporary protective soil coverings.

2. The Contract Drawings indicate the minimum requirements for sedimentation control. The Contractor shall install all measures needed to control sediment and erosion as required by the Contractor and Sub-contractor's construction methods and operations, the weather conditions, and as directed by the Engineer.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 312000 – EARTH MOVING for excavation, backfill and compaction requirements.
2. Section 334000 – STORM DRAINAGE UTILITIES for drainage systems requirements.

1.3 SUBMITTALS

A. Refer to SECTION 013000-SUBMITTALS for submittal provisions and procedures.

1. At least 20 days prior to the start of the project, the Contractor shall submit a Storm Water Pollution Prevention Plan (SWPPP) indicating project phasing, Contractor operation areas, work areas, stockpile locations, construction staging/sequencing, and sedimentation/erosion control measures to be used. The SWPPP shall be prepared to meet the requirements of the United States Environmental Protection's (EPA) National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges From Construction Activities (GCP). The Contractor shall also submit the EPA "Notice of Intent for Storm Water Discharges Associated with CONSTRUCTION ACTIVITY Under a NPDES General Permit." (NOI) form. This form shall be submitted to the EPA at least 14 days prior to the start of any construction activity and placing a signed copy along with proof of mailing in the SWPPP.
2. As part of the Contract Closeout procedures, the Contractor is responsible for filing a Notice of Termination with the EPA once the project has been completed and is permanently

stabilized. Stabilization is complete when all temporary storm water and erosion controls have been removed, all permanent storm water and erosion controls are in place and functional and all vegetated areas are at least 70% viable.

3. The Contractor shall provide the following samples and/or submittals for approval. Do not order materials until approval of samples, certifications or test results has been obtained. Delivered materials shall closely match the approved samples.

    a. Siltation Fence: Submit manufacturer's literature, material specification, and installation instructions.
    b. Mulch Material: Submit one cubic foot sample(s).
    c. Mesh or Blanket Matting: submit one square foot sample(s) and manufacturer's literature, material specification, and installation instructions.

4. The Contractor shall install and maintain sedimentation control devices during construction to prevent the movement of sediment from the construction site to off site areas, into adjacent water bodies via surface runoff or into underground drainage systems. Measures to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at no additional cost to the Owner.

1.4 QUALITY ASSURANCE

A. Comply with all applicable requirements of governing authorities having jurisdiction. The specifications and drawings are not represented as being comprehensive, but rather convey the intent to provide complete slope protection and erosion control for both the Owner’s and adjacent property.

    1. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to a sediment and erosion control plan specific to the site, which complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

B. Erosion control measures shall be established at the beginning of construction and maintained during the entire period of construction. On-site areas which are subject to severe erosion, and off-site areas which are especially vulnerable to damage from erosion and/or sedimentation, are to be identified and receive special attention.

C. The Contractor shall install and maintain sedimentation control devices during construction to prevent the movement of sediment from the construction site to off site areas, into adjacent water bodies via surface runoff or into underground drainage systems. Measures to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at no additional cost to the Owner.

D. All land-disturbing activities are to be planned and conducted to minimize the size of the area to be exposed at any one time, and the length of time of exposure.

E. Surface water runoff originating upgrade of exposed areas shall be controlled to reduce erosion and sediment loss during the period of exposure.

F. When the increase in the peak rates and velocity of storm water runoff resulting from a land-disturbing activity is sufficient to cause accelerated erosion of the receiving stream bed, provide measures to control both the velocity and rate of release so as to minimize accelerated erosion and increased sedimentation of the stream.

G. All land-disturbing activities are to be planned and conducted so as to minimize off-site sedimentation damage.

H. The Contractor is responsible for cleaning out and disposing of all sediment once the storage capacity of the sediment facility is reduced by one-half.

I. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

1.5 REFERENCE STANDARDS

A. The following standards are applicable to the work of this Section to the extent referenced herein:

1. "Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas, A Guide for Planners, Designers and Municipal Officials", prepared by the Massachusetts Department of Environmental Protection, Bureau of Resource Protection, dated March 1997, reprinted May 2003.

1.6 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.7 PERMITS, CODES AND REGULATIONS

A. Comply with all rules, regulations, laws and ordinances of the City and State, and all other authorities having jurisdiction over the project site. All labor, materials, equipment and services necessary to make the work comply with such requirements shall be provided by the Contractor without additional cost to the Owner.

B. Comply with all applicable regulations of the Commonwealth of Massachusetts Department of Environmental Protection (DEP) and the EPA.

C. The Contractor shall comply with the requirements of the NPDES GCP for this project.

PART 2 - PRODUCTS

2.1 SILTATION FENCE

A. Siltation fence shall consist of the following elements:

1. Fabric for siltation fence shall be a minimum width of 3 feet and conforming to the following criteria:

MINIMUM ACCEPTABLE

Fabric Properties	Value	Test Method
Grab Tensile Strength (lbs)	124	ASTM D 4632
Elongation of Failure (%)	15	ASTM D 4632
Mullen Burst Strength (PSI)	300	ASTM D 3786
Puncture Strength (1bs)	65	ASTM D 4833
Flow Rate (gal/min/sf)	10	ASTM D 4491
Apparent Opening Size (sieve)	30	ASTM D 4751
Ultraviolet Radiation (% strength retained)	70	ASTM D 4355

2. Use only commercially available fabric that is certified in writing by the manufacturer for the purpose intended.
3. Acceptable fabric materials include "Mirafi Envirofence" by TC Mirafi, "Style 2130" by Amoco Fabrics Co., and "FX-55" by Carthage Mills, or approved equal by the Engineer.
4. Silt fence posts: Posts may be wood or metal. Wood post shall be a minimum 1¼ inch by 1¼ inch by 5 feet long hardwood stakes commonly used to support siltation fabric. Metal posts shall be a minimum of 1 inch wide and 5 feet long. Posts shall be spaced at a maximum distance of 8 feet on center.
5. Provide suitable heavy nylon cord for securing abutting silt fence posts.

2.2 CRUSHED STONE

A. Crushed stone shall be as specified in Section 312000, Earth Moving.

2.3 STRAW BALES

A. Straw bales shall be of wire or nylon bound bales of straw.

B. Stakes for bales shall be one of the following materials. Lengths shall be approximately three feet (3').

1. Wood stakes of sound hardwood, one inch by one inch (1" x 1") in size.
2. Steel reinforcing bars of at least No. 4 size.

2.4 TEMPORARY COVERS FOR DRAINAGE STRUCTURES

A. Filter fabric for use as temporary covers for drainage structures shall be the same as noted above for siltation fence.

B. Wire mesh for use at temporary drainage structure covers shall be 6" x 6", W2.9 welded wire mesh.

C. Crushed stone shall be as specified herein before.

D. Silt-Sac, Hydro-FloGard + Plus Catch basin Insert, Ultra-DrainGuard Insert, or approved equal, may be used in lieu of hay bales and filter fabric at catch basins.

2.5 TEMPORARY PROTECTIVE COVERINGS

A. During establishment of vegetative covers, provide temporary protective coverings on ground areas subject to erosion of one of the following protective measures, as directed by the Engineer:

1. Hay or straw temporary mulch, 100 pounds per 1,000 square feet.
2. Wood fiber cellulose temporary mulch, 35 pounds per 1,000 square feet.

3. Tackafier for anchoring mulch or straw shall be a non-petroleum based liquid bonding agent specifically made for anchoring hay or straw.
4. Temporary vegetative cover for graded areas shall be undamaged, air dry threshed straw or hay free of undesirable weed seed.
5. Mesh or Blanket Matting: Matting for erosion control on seeded or hydroseeded slopes, on planted surfaces, drainage swales, and on temporary or permanent slopes shall be:

    a. Biodegradable straw, excelsior wood, or coconut fiber and photodegradable netting sewn together with cotton thread.
    b. A flexible three-dimensional web of bonded polypropylene or PVC monofiliments.
    c. Heavy jute mesh shall be of a uniform open plain weave of unbleached singe jute yarn.
    d. Use only commercially available blanket mattings that are designed specifically for the intended use and certified in writing by the manufacturer for the purpose intended.
    e. Erosion control matting shall be "Soil Saver" manufactured by Jim Walls Co., Dallas, TX; "Heavy Duty Jute Mesh" manufactured by Lewis International Corp., Springfield, NJ or approved equal.

Note that wire staples and non-biodegradable coverings shall not be used for any area that will be mown turf.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. The Contractor shall provide suitable and adequate means of sedimentation and erosion control during construction. Control measures shall prevent all erosion, siltation and sedimentation of waterways, drainage systems, construction areas, adjacent areas and off-site areas. Work shall be accomplished on and/or adjacent to the following work areas:

1. Earthwork stockpiles and on-site storage and staging areas.
2. Cut and fill slopes and other stripped and exposed graded areas.
3. Constructed and existing swales and ditches.
4. Unestablished lawns and seeded embankments.

B. Means of protection as noted on the Contract Drawings indicate the minimum provisions necessary. Additional means of protection shall be provided by the Contractor as required for continued or unforeseen erosion problems, at no additional expense to the Owner.

C. Periodic maintenance of all sediment control installations shall be provided to ensure intended purposes are accomplished. Sediment control measures shall be in working condition at the end of each day.

D. After any significant rainfall, sediment control devices shall be inspected for integrity. Any damaged device shall be corrected immediately.

E. The Contractor shall provide adequate means of control of runoff, as to not detrimentally impact downstream conditions during construction. The Contractor shall plan his operations so that permanent drainage mitigation systems such as detention/retention/infiltration basins and chambers are in place and properly functioning prior to connecting upland drainage flows to these systems. The Contractor shall plan his operations such that downstream drainage mitigation measures are in place and functioning before attempting to tie in upgradient drainage systems.

F. In the event that the Contractor is unable to sequence the work so that construction of the permanent drainage mitigation systems precedes the upland work, then the Contractor shall submit a plan indicating his proposed methods of otherwise controlling runoff from the site.

G. The "Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas" should be consulted as a guide for the selection and installation of Best Management Practices to suit the conditions encountered.

3.2 SILTATION FENCE

A. Install silt fence, well-staked at maximum eight-foot intervals in locations as shown on Contract Drawings and as directed. Staking shall occur on the disturbed area side.

B. Secure fabric to posts on upstream side and bury fabric end within a 6-inch wide by 6-inch deep cut-in trench. Wrap the fabric bottom around the inside of the trench and backfill excavated soil into the fabric pocket to anchor the fence fabric.

C. Inspect siltation fence after major storm events and periodically and remove accumulated sediment and debris. If a breach or failure of the siltation fence occurs, the fence shall immediately be restored.

3.3 STRAW BALE BARRIERS

A. Install Straw bales in location as shown on Contract Drawings and as directed.

1. Bales shall be placed in a row with ends tightly abutting the adjacent bales.
2. Each bale shall be embedded in the soil a minimum of four inches (4").
3. Bales shall be securely anchored in place by stakes or re-bars driven through the bales and a minimum eighteen inches (18") into the soil. The first stake in each bale shall be angled toward the previously laid bale to force bales together.

B. Inspection shall be frequent and repair or replacement shall be made as needed.

C. Bales shall be removed when they have served their usefulness so as not to block or impede stormwater flows or drainage.

3.4 STABILIZED CONSTRUCTION ENTRANCE AND STONE BERMS

A. Stone size: Use ASTM designation C-33, size No. 2 (1-1/2” to 2-1/2”). Use crushed stone.

B. Length: As effective, but not less than 50 feet.

C. Thickness: Not less than eight inches.

D. Width: Not less than full width of all points on ingress or egress, but not less than 25 feet.

E. Washing: When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch, or watercourse through the use of sand bags, gravel boards or other approved methods.

F. Maintenance: The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-or-way. This may require periodic top dressing with additional stone

as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spoiled, dropped, washed or tracked onto public rights-of-way must be removed immediately.

G. Place crushed stone berms in locations required and as directed. Berms shall have side slopes of 1:3 or less.

H. Inspect stone berms periodically and replace and/or regrade crushed stone as required.

3.5 TEMPORARY COVERS FOR DRAINAGE STRUCTURES

A. Install temporary covers at drainage structure locations that may be subject to erosion infiltration and as directed by the Engineer.

B. Inspect drainage structures periodically. Remove sediment accumulation and regrade or replace materials as required.

3.6 TEMPORARY PROTECTIVE COVERINGS

A. Place temporary soil coverings to control erosion and sedimentation on all disturbed or graded areas as required by the construction methods employed and as directed by the Engineer. Erosion control matting shall be installed in all areas seeded or hydroseeded with slopes of one vertical foot to three foot horizontal, or steeper, immediately after such areas have been seeded and a hay mulch applied as follows:

1. The area to receive matting shall have been recently seeded and shall have a smooth surface free front stones, clods or depressions.
2. Roll out of the matting perpendicular to the slope, do not stretch the fabric. In drainage swales, center the fabric along the flow line. Install the matting in a check slot at the top and bottom of the slope and at the edges of the area to be covered. Check slots shall be six inches deep and six inches wide. Fabric shall extend down one wall of the check slot and across the full width of the base. Overlap edges of matting rolls four (4) inches minimum and overlap the ends eighteen (18) inches minimum.
3. Install staples in check slots, edges, center and ends of rolls by driving specified steel staples two feet on center over the entire area to be covered except at check slots and ends of rolls, where staples shall be placed six inches on center. All staples shall be driven below finished grade.
4. Fill check slots with loam and tamp firmly.
5. Reseed check slots and all disturbed areas per Specifications.
6. Following matting installation, roll the entire area with a smooth drum roller weighing between fifty and seventy-five (50-75) pounds per linear foot of roller. The finished installation of matting shall be firmly in contact with the seeded area and provide a smooth, finished appearance free from lumps or depressions.

B. Install erosion control matting as a temporary ground cover in all disturbed or graded areas subject to erosion and as directed by the Engineer. The temporary ground cover shall protect the site from erosion until a full permanent lawn can be installed. Install and anchor in place temporary erosion control matting in accordance with manufacturer's printed instructions or as directed by the Engineer and remove all temporary erosion control matting prior to installation of a permanent lawn.

C. Inspect protective coverings periodically and reset or replace materials as required.

3.7 EROSION CONTROL GRASSING

A. Grassing shall be applied according to State of Massachusetts Highway Department Standard Specifications.

3.8 DUST CONTROL

A. Throughout the construction period the Contractor shall carry on an active program for the control of fugitive dust within all site construction zones, or areas disturbed as a result of construction. Control methods shall include the following: Apply calcium chloride at a uniform rate of one and one-half (1 ½) pounds per square yard in areas subject to blowing. For emergency control of dust apply water to affected areas. The source of supply and the method of application for water are the responsibility of the contractor.

B. The frequency and methods of application for fugitive dust control shall be as directed by the Architect with concurrence by the Owner's representative.

3.9 TEMPORARY PROTECTIVE COVERINGS (AFTER GROWING SEASON)

A. Place temporary covering for erosion and sedimentation control on all areas that have been graded and left exposed after October 30. Contractor shall have the choice to use either or both of the methods described herein.

B. Hay or straw shall be anchored in-place by one of the following methods and as approved by the Architect with concurrence by the Owner's representative: Mechanical "crimping" with a tractor drawn device specifically devised to cut mulch into top two inches of soil surface or application of non-petroleum based liquid tackifier, applied at a rate and in accordance with manufacturer's instructions for specific mulch material utilized.

C. Placement of mesh or blanket matting and anchoring in place shall be in accordance with manufacturer's printed instructions.

D. Inspect protective coverings periodically and reset or replace materials as required.

3.10 REMOVAL AND FINAL CLEANUP

A. Once the site has been fully stabilized against erosion, and with the approval of the Owner's Representative remove sediment control devices and all accumulated silt. Dispose of silt and waste materials offsite. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated.

END OF SECTION 312500

SECTION 32 1313

SITE CONCRETE

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

A Work Included: Provide all labor, materials, equipment, services and transportation required to complete concrete work as shown on the Drawings and as specified herein or both.

a Concrete Walls.
b Concrete Pavement Pedestrian.
c Concrete Pavement Pedestrian – Integral Color.
d Concrete Pavement – Vehicular.
e Concrete Bands.

B Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.

1 Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

1.03 RELATED WORK

A The following Related Work to be performed under the designated Sections:

1 Electrical – Section 26 0001
2 Earthwork - Section 31 2000
3 Finish Grading - 31 2219
4 Miscellaneous Site Improvements - Section 32 3000
5 Cast-In-Place Concrete - Section 03 3000

1.04 REFERENCES

A Reference standards and specifications refer to Cast-In –Place Concrete Section 03 3000.

B Codes and Standards: Comply with provisions and codes, specifications and standards, except where more stringent requirements are shown or specified in Cast-In-Place Concrete Section 03 3000.

1.05 SUBMITTALS

A Submit the following in accordance with the provisions of Section 01 3300 – Submittals.

B Product Data: Manufacturer's current catalogue cuts and specifications and suppliers material certificates for the following:

1 Cement concrete design mix

a 4000 PSI mix

2 Pre-molded expansion joint items

a Sealant.
b Pre-molded expansion joint.

3 Concrete curing compound

4 Welded wire mesh.

5 Steel wire.

6 Supports for reinforcement.

7 Dowels.

8 Dowel caps and dowels.

9 Integral colored concrete pigment(s).

10 Evaporation retarder.

C Certificates of Compliance

1 Reinforcing Steel: Certificate of compliance.

2 Concrete Mix Design: Ticket for each batch delivered showing the following:

a Mix identification.

b Weight of cement, aggregate, water, and admixtures, aggregate sizes/proportion, and air entrainment.

D Shop Drawings

1 Minimum 3/8" inch scale drawings showing dimensions, sizes, thickness, guages, finishes, joining, attachments and relationship of work to adjoining construction and existing conditions.

a Concrete Walls.
b Concrete Stairs.
c Concrete Bands.

2 Coordinate all sleeves for utilities and other items and curbs and show them on the shop drawings.

1.06 TESTS

A Slump tests for cement concrete for each batch of concrete

1 Slump limits: Refer to Section 03 3000 Cast-In-Place Concrete.

1.07 QUALITY ASSURANCES

A Mock-Ups

1 The Contractor shall construct on site mock-up panels for each type of concrete finish to prototypically replicate the entire pattern, and concrete color(s) and showing all joints, finishes, saw cuts, score lines and expansion joints with sealant colors for approval by the Landscape Architect. The Contractor shall provide as many mock-ups that may be required to obtain approval from the Landscape Architect.

Note that the color of the cement, sands, and aggregates will be evaluated as part of the mock-up process. Mock-up samples may be required to provide comparisons of differing combinations of cement, sands, and aggregates.

2 Colored concrete mock-up and stamped colored concrete mock up(s): The contractor shall allow for up to three colors (from mfg. standard colors) to be mocked up for the selection of one color to be approved for use on the project. **The contractor shall allow in his schedule sufficient curing time for the cured color to be reviewed by the landscape architect (generally about 30 days).**

3 Mock-ups shall be provided for approval by the Landscape Architect prior to construction. Once approved, the mock-ups shall serve as the standard for the balance of the work and shall be protected against damage until final approval of the remaining work. The mock-up panels shall be removed at the end of construction of the concrete items and the specified materials be installed in place of the panels.

B Mock-up panels

1	Concrete walk	6' x 6'
2	Colored concrete walk	6' x 6'
3	Concrete wall	1' high x 6' long
4	Handicap ramp	1

1.08 PROJECT CONDITIONS

A Work notification: Notify Landscape Architect at least 48 hours prior to installation of concrete.

B Establish and maintain required lines, surfaces and elevations.

C Do not install concrete work over wet, saturated, muddy or frozen subgrade.

D Protect adjacent work.

1.09 DEFINITIONS

A References to Landscape Architect shall mean Architect or the Architect's designated representative.

PART 2 – MATERIALS

2.01 STRUCTURAL FILL AND DENSE GRADED CRUSHED STONE: Refer to Section 31 2000 Earthwork for all requirements.

2.02 CONCRETE MIXES: 4000-PSI Mix for all Site Concrete including Vehicular and Pedestrian Paving. Refer to Cast-In-Place Concrete Section 03 3000.

2.03 FORM MATERIALS: Refer to Cast-In-Place Concrete Section 03 3000.

2.04 REINFORCING MATERIALS: Refer to Cast-In-Place Concrete Section 03 3000.

2.05 MISCELLANEOUS MATERIALS: Refer to Cast-In-Place Concrete Section 03 3000.

2.06 EXPANSION JOINT MATERIALS: Refer to Cast-In-Place Concrete Section 03 3000.

2.07 MIXTURE COMPONENTS

A Coloring Agent:

1 Type: Liquid or Powered integral color designed to color the cement paste in a concrete mixture.

2 Percentage: as recommended by supplier.

3 Product: Liquid or Powdered Integral color admixtures as produced by Schofield, 800-800-9900, www.scofield.com , Brickform, 800-483-9628, www.brickform.com or equal

4 Color: Two colors from the company standard color chart available from Schofield, Brickform or approved equal.

2.08 MISCELLANEOUS MATERIALS

A Preformed Expansion Joint Filler: Shall be 1/2" x depth of paving, ethafoam with 3/4" inch tear strip to be later replaced by sealant.

B Polyurethane Joint Sealant: Joint sealant shall be Sikaflex-2C cold-applied, two-component, moisture cured, non sag elastomeric joint sealing compound, or approved equal, suitable for use on horizontal joints. Color shall match concrete color.

C Concrete Curing Compound: VOCOMP 20 non-yellowing with a fugitive dye, visible only during installation or approved equal shall be the Concrete Curing Compound. The approved Concrete Curing Compound shall be compatible with the approved Concrete Sealer and/or the colored concrete admixtures.

D Dowel caps and dowels for attaching concrete slabs shall be hot dip galvanized and sized as shown on the drawings.

E Concrete Sealer: VOCOMP 25 non-yellowing with a fugitive dye, visible only during installation, or approved equal shall be the Concrete Sealer. The approved Concrete Sealer shall be compatible with the approved Concrete Curing Compound.

For colored concrete, the concrete sealer shall be chemically compatible with the color additives and be part of a “system” of products available from the colorant manufacturer.

F Backer Rod:

1 Type: Compressible polyethylene foam rod or other flexible, permanent, durable non-absorptive material as recommended by joint sealer manufacturer for compatibility with joint sealer.

2 Product: "Sonofoam Backer Rod" by Sonneborn Building Products, (612) 835-3434 or approved equal.

PART 3 – EXECUTION

3.01 PREPARATION

A Subgrade preparation and the installation of the Structural Fill and Dense Graded Crushed Stone shall be found under Section 31 2000 Earthwork, of these specifications. Subgrade shall be moistened as required to provide a uniform dampened condition at the time concrete is placed.

B Verify lines, levels and locations of formed concrete work. Verify that form dimensions comply with drawing dimensions.

3.02 FORMS: Refer to Cast-In-Place Concrete Section 03 3000.

3.03 PLACING REINFORCEMENT: Refer to Cast-In-Place Concrete Section 03 3000.

3.04 INSTALLATION OF EMBEDDED ITEMS: Refer to Cast-In-Place Concrete Section 03 3000.

3.05 PREPARATION OF FORM SURFACES: Refer to Cast-In-Place Concrete Section 03 3000.

3.06 INTREGAL COLORED CONCRETE

A Provide colorant in the proportions recommended by the manufacturer and as related to the approved mock-up. Each area of colored paving on the project shall be installed in continuous pours. Should more than 1 batch (truck load) be required to complete the area, the concrete color shall be consistent in formula with adjacent pour(s).

B Provide sealant at the rates of application and methods as recommended by the manufacturer. Follow the manufacturer’s recommendations as to the timing of the sealant application.

3.07 EXPANSION JOINTS

A Expansion joints shall be located as shown on the Drawings; at all interfaces of paving to walls, brick walls curbs, buildings, stairs, concrete benches, light pole bases, flagpole bases; and as directed by the Landscape Architect. Expansion joints are not required at the back of vehicular curbs at vehicular areas.

3.08 CONTROL JOINTS: Refer to the Drawings.

3.09 CONCRETE PLACEMENT: Refer to Cast-In-Place Concrete Section 03 3000.

3.10 CONCRETE SLAB FINISHING

A Preparation

1 After placing slabs, plane surface to the grades shown on the drawings. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushed brooms or rakes.

2 After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats or by hand-floating if area is small or inaccessible to power units. Float the surface with aluminum or magnesium floats after edging and jointing operations. Cut down high spots and fill low spots. Uniformly slope surfaces to drain. Immediately after leveling, refloat surface to a uniform, smooth, granular texture. Immediately following floating, the surface shall be steel-troweled.

3 All walks must be a maximum of 5%. Any discrepancies shall be brought to the attention of the landscape Architect before the installation of the paving.

4 Cross-slopes including but not limited to walkways, plazas, sidewalks, play surfaces, pedestrian paving, vehicular drop off area and handicap parking areas shall be graded at a maximum of 2 % cross slope. Any discrepancies shall be brought to the attention of the landscape Architect before the installation of the paving.

B Finishes

1 Concrete Walk, Colored Concrete Walk and Handicap Ramp - Light Broom Finish: After floating, achieve finish by dragging a fine bristle brush over the floated finish. No ‘picture frames’ are to show from edging the joints.

3.11 CONCRETE WALLS AND OTHER EXPOSED SITE CONCRETE FINISHING

A Sand Blast Finish.

1 Schedule: Perform sand-blasting no sooner than 10 days after pouring each section of concrete

2 Continuity: Perform in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish.

3 Depth of Cut: Use an abrasive grit of the proper type and gradation to expose the aggregate and surrounding matrix surfaces to be approx. 1/16 in. depth.

4 Backup Boards: Blast corners and edge of patterns carefully, using backup boards in order to maintain a uniform corner or edge line.

5 Uniformity: Use same nozzle, nozzle pressure and blasting technique as used for sample panel.

6 Control: Maintain control of abrasive grit and concrete dust in each area of blasting.

7 Clean Up: Remove all expended abrasive grit, concrete dust and debris at the end of each day of blasting operations.

3.12 CONCRETE CURING AND PROTECTION: Refer to Cast-In-Place Concrete Section 03 3000.

3.13 REMOVAL OF FORMS: Refer to Cast-In-Place Concrete Section 03 3000.

3.14 MISCELLANEOUS CONCRETE ITEMS

A Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

3.15 MINOR CONCRETE SURFACE REPAIRS

A Patching of defective areas will be determined by the Landscape Architect prior to any patching. Only minor patching will be allowed where approved by the Landscape Architect.

1 Work determined to be unacceptable and in excess of minor patching as determined by the Landscape Architect shall be removed and replaced by the Contractor to the satisfaction of the Landscape Architect at no additional expense to the Owner.

B Minor Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Landscape Architect. All voids and cavities on all surfaces shall be completely filled with stiff mortar of same composition and air-entrainment as the mortar in the original concrete mix. The same brand and color of cement, and the same kind and color of fine aggregate used in the original concrete shall be used in this mortar. The mortar shall be mixed, allowed to set for thirty (30) minutes and then remixed before placing in the work. Carefully remove surface film from these pointed areas before the mortar sets. If surfaces exposed to view do not present a uniformly smooth, clean surface of even texture and appearance when prepared in accordance with foregoing, they shall be rubbed to obtain a satisfactory finish. Surfaces shall be wetted with clean water and rubbed with a carborundum brick without applying any cement or other coating until smooth and uniform in appearance.

C Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired by the Contractor to satisfaction of Landscape Architect at no additional expense to the Owner.

1 Surface Repair Items: Surface defects, as such as but not limited to include color and texture irregularities, cracks, spalls, honey combing, rock pockets, fins and other projections on surface and stains that cannot be removed by cleaning and other conditions as determined by the Landscape Architect.

D Repair methods not specified above may be used, subject to acceptance of Landscape Architect.

END OF SECTION

SECTION 32 1800

BITUMINOUS CONCRETE PAVING AND ATHLETIC SURFACING

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

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

1 Bituminous concrete paving and athletic surfacing work as shown on the Drawings and as specified herein or both.

B Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.

1 Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

1.03 RELATED SECTIONS

A Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division One of these Specifications and the following:

1 Earthwork - Section 31 2000
2 Finish Grading - Section 31 2219
3 Fencing - Section 32 3100
4 Miscellaneous Site Improvements - Section 32 3000
5 Soil Preparation - Section 32 9113
6 Lawns - Section 32 9200
7 Planting - Section 32 9000
8 Site Concrete – Section 32 1313
9 Landscape Subdrainage – Section 33 4610
10 Landscape Drainage – Section 33 4620

Unless otherwise specified, bituminous concrete material and workmanship shall comply with the applicable provisions of the latest edition Standard Specifications For Highways and Bridges, Department of Public Works of the Commonwealth of Massachusetts for the items noted herein. This document shall be referred to as The Standard Specifications.

1.04 SUBMITTALS

A Submit the following in accordance with the provisions of Section 01 3300 – Submittals.

B Product Data: Manufacturer's current catalogue cuts and specifications and suppliers material certificates for the following:

1 Bituminous Materials:

a Bituminous Concrete Base Course.

b Bituminous Concrete Modified Top Course.

c Bituminous Tack Coat.

d Certificates: Certificates that each material complies with the Specifications and “Standard Specifications”.

e Test Reports:

f Composition and Compaction Acceptance Test as required in M3.11.09, “Standard Specifications.”

2 Play court and playground athletic surfacing items:

a Surface preparations

1) Plexipave Court Patch Binder.
2) Acrylic Resurfacer (1) coat.
3) Fortified Plexipave (3) coats.
4) Plexicolor line paint (2) coats
5) Color chips for each color.

B Shop Drawings:

1 Minimum 1” – 20’ scale plan drawing of the area Tack and High Jump area showing all lines, lane markings, numbers and markings including the location, dimensions and relationships.

1.05 QUALIFICATIONS/SPECIAL REQUIREMENTS

A The athletic surfacing materials shall be one manufacturer's materials only.

B The Contractor shall have at least 5 years experience and at least 10 completed running tracks installing athletic surfacing materials. The contractor must be a member in good standing with the American Sports Builders Association and employ a Certified Track Builder with specific qualifications in installing courts and running tracks.

1.06 JOB CONDITIONS

A Weather limitations

1 Athletic surfacing systems weather limitations are as specified by the manufacturer.

1.07 GUARANTEE

A Paving, Color Surfacing and Painted Lines

1 All paving, color surfacing and painted lines shall be guaranteed for a period of one year from final acceptance, against cracking, peeling, checking or other defect. The Contractor will repair, recoat or otherwise make satisfactory, any failed paving, color surfacing or painted lines at no cost to the Owner.

1.08 DEFINITIONS

A References to Landscape Architect shall mean Architect or the Architects designated representative.

PART 2 – PRODUCTS

2.01 DENSE GRADED CRUSHED STONE

A Refer to Section 31 2000 – Earthwork.

2.02 GEOTEXTILE FABRIC

A Refer to Section 31 2000 – Earthwork.

2.03 BITUMINOUS CONCRETE – PEDESTRIAN AND PLAY AREAS

A Bituminous Concrete Pedestrian Pavement, Track and Play Court and Playground Pavement shall be laid in two courses of depths after rolling, as shown on the Drawings.

1 Bituminous Concrete Paving – Pedestrian:

a Binder Course shall conform to Section M3 of the Standard Specifications.

b Top Course shall conform to the requirements for Dense Mix as specified in Section M3 of the Standard Specifications.

c Tack coat shall be AC-5, AC-10 or AC-20 paving asphalt cement, applied at a rate of 1/20 gallon per square yard or as otherwise indicated.

2 Bituminous Concrete Paving – Play Courts and Playgrounds:

a Binder Course:

Percent By Weight Passing Square Opening Sieve	Percentage Passing
1”	100
3/4”	90-100
3/8”	65-80
#4	46-60
#8	35-45
#30	17-29
#200	2-7
A.C. (% of mix)	5.5-7.5

b Top Course:

Percent By Weight Passing Square Opening Sieve	Percentage Passing
1/2”	100
3/8”	90-100
#4	63-78
#8	50-60
#30	25-42
#200	3-8
A.C. (% of mix)	7.5-9.5

2.04 PLAY COURT AND PLAYGROUND SURFACING ITEMS shall be the PLEXIPAVE SYSTEM as manufactured by California Products Corporation, Cambridge, Massachusetts or The NESCO LATEX-ITE SYSTEM distributed by New England Sealcoating Co., Inc. Hingham, or Equal. The Plexipave Athletic Surfacing Items for application over a bituminous concrete surface are listed below:

A Plexipave Court Patch Binder shall be used to correct any minor surface deficiencies in the Bituminous Concrete Surface.

B Plexipatch.

C Acrylic Resurfacer.

D Fortified Plexipave: Colors as shown on the drawings.

a Plexipave Color Base.

b Plexichrome.

E Plexicolor Line Paint (2) coats per each line: White.

PART 3 – INSTALLATION

3.01 EXAMINATION

A Verification: Verify that bituminous paving has been completed prior to commencement of work and that the surface has been graded to allow for placement of Athletic Surfacing. Verify that all adjacent materials have been installed to allow for the Athletic Surfacing.

B Curing: the bituminous pavement shall cure for fourteen days prior to applying Athletic Surfacing.

C Notification: Notify Landscape Architect of conflicts discovered on the site, or prior work done by others, which would prevent proper installation of Athletic Surfacing.

3.02 GEOTEXTILE FABRIC

A Refer to Section 31 2000 – Earthwork.

3.03 BITUMINOUS INSTALLATION: REFER TO DETAILS FOR MATERIALS FOR EACH APPLICATION

A Installation procedures for bituminous concrete pavements shall comply with Standard Specifications, Section 420.

B Installation of bituminous concrete paving shall be as shown on the Drawings and specified herein.

C Align bituminous concrete walks and patches as shown on the Drawings.

1 Obtain landscape architect's approval layout of all walks before work is done. Make adjustments as required in the layout to ensure smooth continuous curves and straight lines and transitions.

D Subgrade preparation and installation of Gravel Base Course shall be found in Section 31 2000 - EARTHWORK, of these specifications.

E Make any corrections necessary to subbase course (minor cuts and fills) furnished and installed under Section 31 2000 - EARTHWORK, to bring to the sections and elevations shown on the Drawings.

F Remove loose material from compacted gravel base surface immediately before installing bituminous concrete. Proof roll prepared gravel base surface to check for unstable areas requiring additional compaction. Do not begin paving work until deficient gravel base areas have been properly compacted as specified.

G Construct Bituminous Concrete Paving in accordance with the Standard Specifications Sections 420 and 460.

H No bituminous material shall be applied when the temperature is below 32° F.

I No vehicular traffic of any kind shall be allowed to pass over the newly finished surface until it has had time to set. Twenty-four hours will be considered sufficient time for the

pavement to set in most cases, but this period may be extended by the Engineer as required by weather or other reasons.

J The Contractor shall ensure that positive drainage occurs on all walks, patches and court surfaces. All areas of finished paving on which water stands or which are found excessively uneven shall be promptly brought to the correct grade and line. There shall be no deviation from true surface planes represented by the grade elevations shown on the Drawings.

K Pavement Edges: The Contractor shall construct a neat tamped edge as shown on the Drawings at all proposed pavement edges not abutting vertical faces of adjacent structures or pavements. New paving shall be well blended into adjoining existing paving and thoroughly rolled to present continuous uniform surface without perceptible arises or depressions at the jointure.

L The bituminous pavement shall cure for fourteen days prior to applying the Color Surfacing or Line Paint.

M Do any repair or patching to pavements outside the project site damaged by the work of the Contract.

N All cuts in existing pavement shall be "saw cut".

3.04 TACK COAT

A Apply to contact surfaces of existing or previously constructed asphalt or portland cement concrete and surfaces abutting or projecting into bituminous concrete pavement. Distribute at a rate of 0.30 to 0.35 gallons per square yard of surface or greater to provide complete coverage.

1 Apply tack coat to vertical surface of all saw cut existing bituminous concrete.

B Allow to dry or until at proper condition to receive paving.

3.05 APPLICATION OF PLAY COURT AND PLAYGROUND SURFACING AND LINES

A Surfacing and lines shall be applied in strict conformance with the manufacturer's specifications and requirements and as specified herein.

B Bituminous Paving Surface Preparation: Preparation for areas requiring athletic surfacing shall be cleaned before installation of each of these items as follows:

1 All dirt, sand, dust and other loose debris materials and grease, oils and other foreign materials shall be cleaned from the paved areas to be covered by sweeping with brooms and pressure washing with water and or other methods as applicable.

2 Prior to the application of surfacing materials, the entire surface shall be checked and all minor depressions or irregularities located.

3 The surface shall then be flooded and any depressions covering a nickel shall be located and corrected as follows:

a The Court Patch Binder, mixed as recommended by the manufacturer, shall be applied over all these depressions according to the

manufacturer's instructions. Apply (1) coat of Tack Coat of (1) part Court Patch Binder and (2) parts water according to the manufacturer's instructions.

b The finished patching surface shall not vary more than 2% inch in 10 feet measured in any direction and shall blend smoothly with adjacent unpatched areas.

C Surface Course Preparation: Apply (1) application of Acrylic Resurfacer per manufacturer's specifications.

D Fortified Plexipave: Apply (3) coats as per manufacturer's specifications.

E Plexicolor Line Paint: Apply (2) coats as per manufacturer's specifications.

END OF SECTION

SECTION 32 1810

PLAYGROUND SAFETY SURFACING

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 SCOPE OF WORK

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

1 Playground safety surfacing work as shown on the Drawings and as specified herein or both.

B Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.

1 Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

1.03 RELATED WORK

A The following Related Work to be performed under the designated Sections:

1 Earthwork - Section 31 2000
2 Finish Grading - Section 31 2219
3 Bituminous Concrete and Athletic Surfacing – Section 32 1800
4 Fencing - Section 32 3100
5 Miscellaneous Site Improvements - Section 32 3000
6 Soil Preparation - Section 32 9113
7 Lawns - Section 32 9200
8 Planting - Section 32 9000
9 Site Concrete – Section 32 1313
10 Landscape Subdrainage – 33 4610
11 Playground Equipment – By Owner

1.04 REFERENCES

A Unless otherwise specified, bituminous concrete material and workmanship shall comply with the applicable provisions of the latest edition Standard Specifications For Highways and Bridges, Department of Public Works of the Commonwealth of Massachusetts for the items noted herein. This document shall be referred to as The Standard Specifications.

B American Society for Testing and Materials (ASTM):

1 ASTM F1292 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.

2 ASTM F1951 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.

1.05 OWNER'S INSTALLATION OF PLAY EQUIPMENT

A Install Playground Safety Surfacing after the Owner has installed the playground equipment. Owner to design equipment to be compatible with Playground Safety System performance standards described in 1.05 and on the approved shop drawings.

1.06 SYSTEM DESCRIPTION – WOOD FIBER PLAYGROUND SYSTEM

A Test results for Engineered Wood Fiber for impact attenuation in accordance with ASTM F 1292 Stand Specifications for Impact Attenuation for Surface Systems Under and Around Playground Equipment. G-max values of less than 120G for 12” system at 12’ drop heights and HIC values of less than 1,000 for both new and 12 year old material.

B Test results for the Engineered Wood Fiber in accordance with ASTM F 2075 Specifications for Engineered Wood Fiber for Use as Playground Safety Surface Under and Around Playground Equipment.

C Test results in accordance with ASTM F 1951 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.

D Test results in accordance with ASTM F 1292 for Mats showing G-max values less than 200G, and HIC values less than 1,000 for a 3’ drop.

E Certification that the surface meets the intent of the Americans with Disabilities Act (ADA).

F Written manufacture’s 25 year warranty against loss of resiliency, lifetime warranty of felt fabric material.

G Provide product liability insurance certificate with project owner named as certificate holder.

1.07 SUBMITTALS

A Submit the following in accordance with the provisions of Section 01 3300 – Submittals.

B Product Data: Submit manufacturer’s product data and installation instructions.

C Shop Drawings:

1 Minimum 3/8” scale plans and section drawing of the area of Playground Surface installation showing the location, dimensions details and relationships of the Playground Surfacing.

D Quality Assurance/Control Submittals: Submit the following:

1 Certificate of qualifications of the playground surfacing installer.

E Closeout Submittals: Submit the following:

1 Warranty documents specified herein.

1.08 QUALITY ASSURANCE

A Qualifications: Utilize an installer approved and trained by the manufacturer of the playground surfacing system, having experience with other projects of the scope and scale of the work described in this section.

B Certifications: Certification by manufacturer that installer is an approved applicator of the playground surfacing.

C International Play Equipment Manufacturers Association (IPEMA) certified.

1.09 DELIVERY, STORAGE & HANDLING

A Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at a minimum temperature of 40 degrees F (4 degrees C) and a maximum temperature of 90 degrees F (32 degrees C).

1.10 PROJECT/SITE CONDITIONS

A Do not install in steady or heavy rain.

1.11 WARRANTY

A Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.

1 Warranty Period: 5 years from date of completion of work.

1.12 DEFINITIONS

A References to Landscape Architect shall mean Architect or the Architects designated representative.

PART 2 – MATERIALS

2.01 CRUSHED STONE BASE

A Crushed Stone shall meet the following requirements:

Sieve Size	% Passing by Weight
1”	90-100
5/8”	50-80
1/4”	30-50
#4	15-35
#8	10-30
#30	3-5
#200	0-3

2.02 SUBDRAIN SYSTEM

A Refer to Landscape Subdrainage – Section 33 4610.

2.03 WOOD FIBER PLAYGROUND SYSTEM

A FibarSystem no. 312, Fibar Engineered Wood Fiber to a compacted depth of approximately 12 inches over FibarFelt geotextile fabric and FibarDrain drainage matrix as manufactured by The Fibar Group LLC, fibar@fibar.com or approved equal.

B Fibar Engineered Wood Fiber shall be IPEMA-certified Engineered Wood Fiber. Standard wood chips, bark mulch or materials manufactured from recycled pallets will not be acceptable.

C Provide FibarMat under each slide exit and sliding pole

PART 3 – EXECUTION

3.01 EXAMINATION

A Site Verification of Conditions: Verify that the Landscape Drainage and substrate conditions are suitable for installation of the playground surfacing system and that asphalt has been cured for 30 days.

B Do not proceed with installation until unsuitable conditions are corrected.

3.02 MANUFACTURER’S INSTRUCTIONS

A Comply with the instructions and recommendations of the Poured in Place Playground Surfacing manufacturer and Wood Fiber

3.03 SUBDRAINAGE INSTALLATION

A Refer to Section 33 4610 – Landscape Subdrainage.

3.04 DENSE GRADED CRUSHED STONE BASE INSTALLATION

A Install to the depth as shown on the drawings.

B Compact to 95% Standard Proctor Compaction using a tamper, roller or combination of both.

3,05 WOOD FIBER PLAYGROUND SYSTEM

A Install all materials as recommended by the manufacturer and as shown on the approved shop drawings.

3.06 PROTECTION

A Protect the installed playground surface from damage resulting from subsequent construction activity on the site.

END OF SECTION

SECTION 32 1823

INFIELD SURFACING

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

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

1 Infield surfacing work as shown on the Drawings and as specified herein or both.

B Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.

1 Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

1.03 RELATED WORK

A The following Related Work to be performed under the designated Sections:

1 Electrical - Section 26 1000
2 Earthwork - Section 31 2000
3 Soil Preparation - Section 32 9113
4 Fencing - Section 32 3100
5 Miscellaneous Site Improvements - Section 32 3000
6 Planting - Section 32 9000
7 Site Concrete - Section 32 1313
8 Landscape Subdrainage – Section 33 4610

1.04 SUBMITTALS AND SAMPLES

A Submit the following in accordance with the provisions of Section 01 3300: Submittals.

B Product Data: Manufacturer's current catalogue cuts and specifications and suppliers material certificates for the following:

1 Infield Surfacing Items:

a Infield Mix.

b Pitcher's Area/Home Plate and Base Clay.

B Shop Drawings:

1 Minimum 3/8" scale plans and section drawing of the area of Infield Surface installation showing the location, all dimensions details and relationships.

1.05 QUALIFICATIONS / SPECIAL REQUIREMENTS

A The infield surface materials shall be one manufacturer's materials only and one system from that manufacturer.

B The Contractor shall have at least 3 years experience installing infield surface materials.

C The manufacturer's representative shall be engaged by the Contractor at his expense to inspect and monitor the applications of the infield surfacing.

1.06 PROJECT / SITE CONDITIONS

A Weather limitations:

1 Infield surfacing systems weather limitations are as specified by the manufacturer.

1.07 DEFINITIONS

A References to Landscape Architect shall mean Architect or the Architect's designated representative.

PART 2 – MATERIALS

2.01 DRAINAGE BLANKET SAND: Refer to Section 33 4610 – Landscape Subdrainage.

2.02 INFIELD SURFACING: Manufactured by Read Custom Soils, 888-475-5526 or Approved Equal.

A Dura Edge Classic Infield Mix - Read Custom Soils:

Sand: 75%
Silt & Clay: 25%

B Pitcher's Area / Home Plate and Base Clay - Hilltopper Mound Clay by Stabilizer Solutions and available through Read Custom Soils:

Proprietary blend of natural clay and polymer.

PART 3 – EXECUTION

3.01 EXAMINATION

A Verification of Conditions

1 Finish Grades: Finish grades for Drainage Blanket and planting areas shall have been established in another Section. Verify that all grades are within the tolerances required for the application of Infield Surfacing.

3.02 DRAINAGE BLANKET SAND

A Install Drainage Blanket Sand below the infield surface to the top of the Drainage Blanket as shown on the drawings.

3.03 INFIELD SURFACING

A Infield surfacing shall be installed in strict conformance with the manufacturer's specifications to the lines and grades as shown on the Drawings. Materials are to be installed to the minimum depth of 4 inches in 2 inch lifts.

3.04 PITCHER'S AREA / HOME PLATE / BASE SURFACING

A Surfacing shall be installed in strict conformance with the manufacturer's specifications to the lines and grades as shown on the Drawings.

1 Pitcher's Area: Install Hilltoper Mound Clay as specified by the manufacturer.

2 Home Plate and Base Areas: Install Hilltoper Mound Clay in 2 inch lifts to a total minimum depth of 4 inches. Drag a thin covering of Infield Surface material over the top to have a homogeneous color.

3.05 TOLERANCES

A Do not permit finished surfaces to vary more than 1.5% measured with a 10 ft. metal straightedge, except at grade changes.

B No "birdbaths" or other surface irregularities will be permitted. Correct irregularities to the satisfaction of Landscape Architect.

3.06 CLEAN UP

A Remove all remnant and unused materials from job site.

END OF SECTION

SECTION 32 3000

MISCELLANEOUS SITE IMPROVEMENTS

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

A Work Included: Provide all labor, materials, equipment, services and transportation required to complete miscellaneous site improvements work as shown on the Drawings and as specified herein or both.

a Trash and Recycling Receptacles.
b Benches.
c Bicycle Racks.
d Decorative Gravel.
e Flagpole.

B Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.

1 Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

1.03 RELATED WORK

A The following Work to be performed under the designated Sections:

1 Electrical – Section 26 0001
2 Earthwork - Section 31 2000
3 Finish Grading - Section 31 2219
4 Planting - Section 32 9000
5 Site Concrete - Section 32 1313

1.04 SUBMITTALS

A Submit the following in accordance with the provisions of Section 01 3300 – Submittals.

B Product Data: Manufacturer's current catalogue cuts and specifications and suppliers material certificates for the following:

1 Trash and Recycling Receptacles.
2 Benches.
3 Bicycle Racks.
4 Decorative Gravel.
5 Flagpole.

C Samples

1 Paint and finish for all items.

D Shop Drawings

1 Minimum 3/8 inch scale showing dimensions, sizes, thickness, gauges, finishes, joining, attachments and relationships of work to adjoining construction and existing conditions.

a Trash and Recycling Receptacle.
b Benches.
c Bicycle Racks.
d Flagpole.

2 Do no final sizing or finishing until shop drawings and samples for that item of work is approved.

1.05 REFERENCES

A ASTM - American Society for Testing and Materials.

1.06 DEFINITIONS

A References to Landscape Architect shall mean Architect or the Architect's designated representative.

PART 2 – MATERIALS

2.01 DENSE GRADED CRUSHED STONE AND STRUCTURAL FILL: REFER TO SECTION 31 2000 Earthwork for all requirements.

2.02 CEMENT CONCRETE

A Cement Concrete for footings shall be the 4,000 PSI Mix. Refer to Section 32 1313 Site Concrete for all requirements.

2.03 TRASH AND RECYCLING RECEPTACLES (Provide 6 Trash and 6 Recycling Receptacles)

A Acceptable Manufacturers: Provide products which meet or exceed the requirements of these specifications from one of the following manufacturers.

1 Chase Park trash receptacle, side opening, 24” x 40”, surface mounted with 36 gallon ridged plastic liner. Aluminum polyester powdercoat. Appropriate graphics indicating litter and recycling on each receptacle. Color to be selected from standard color chart by the Architect, manufactured by Landscape Forms, 800-381-3455.

2 Retropolitan litter and trash receptacle, surface mounted, Model RTR-LS-36-EL-SS #4 satin-DT with 36 gallon rigid plastic liner and appropriate graphics indicating litter and recycling on each receptacle manufactured by Creative Pipe Inc, (800) 644-8467.

3 Dispatch single stream litter and recycling receptacles, surface mounted, with F+S optional colors to be selected by the Architect, with 45 gallon ridged plastic liner. Appropriate graphics indicating litter and recycling on each receptacle. Manufactured by Form+Surfaces 800-451-0410.

B Manufacturing Requirements: Provide all trash receptacles as a complete unit produced by the same manufacturer only including the receptacle, liner and finishes and all attachments as shown on the drawings or specified herein.

2.05 BICYCLE RACKS (To accommodate 70 bicycles)

A Acceptable Manufacturers: Provide products which meet or exceed the requirements of these specifications from one of the following manufacturers.

1 32 - Model: bola, stainless steel tubing with #4 satin finish, embedded. by Landscape Forms, 800-381-3455.

2 32 -Model: ring, stainless steel tubing with #4 satin finish, embedded. by Landscape Forms, 800-381-3455.

3 32 - Horseshow bike rack HS2-F-SS, embedded by Creative Pipe Inc, (800) 644-8467.

B Manufacturing Requirements: Provide all bicycle racks as a complete unit produced by the same manufacturer only including all attachments as shown on the drawings or specified herein.

2.05 DECORATIVE GRAVEL

A Gravel 1-1/2" – 2" rounded washed clean stone, grayish as selected by the Landscape Architect.

B Edging: Material: Permaloc Corporation, Holland, MI 800-356-9660 or approved equal.

1 Model: "AsphaltEdge" – with sliding aluminum connectors for splicing. Color to be black electrostatically applied, baked-on, acrylic paint.

2 Accessories: 3/8" x 10" spiral steel spike available from edge restraint supplier.

C Filter Fabric: Mirafi # 140.

2.06 FLAGPOLE

A Acceptable manufacturers: Provide products which meet or exceeds the requirements of this equipment by Concord Industries Inc. 800-527-3902, Admiral Flagpoles, Inc. 800-783-7653 or American Flagpoles, 800-368-3090.

B Manufacturing Requirements: Provide all flagpoles as a complete unit produced by the same manufacturer, including pole fittings, accessories, bases and anchoring devices and all other components as shown on the drawings or specified herein.

1 Provide flagpoles and installations to withstand a wind velocity of 120 MPH when flying a flag of 8 feet x 12 feet.

C Materials:

1 Poles: Concealed halyard, single piece cone-tapered aluminum flagpole of seamless extruded tubing.

a Aluminum: Comply with ASTM B 241, alloy 6063-T6, having a minimum wall thickness and tensile strength of not less than 30,000 psi.

b Pole Description:

Exposed Height: 40 feet
Butt Diameter: 8 inches
Wall Thickness: 0.188 inches

c Pole Mounting: Mounting shall be embedded (Ground Set).

1) Steel foundation sleeve shall be corrugated 16 gage galvanized steel tube.

2) Steel base plate and ground spike shall be galvanized steel and dimensioned as shown on the drawings.

3) Spun aluminum pole flash collar, finished to match the flagpole shaft and sized to meet the manufacturers requirements for the selected pole sleeve.

4) Sand as required by the manufacturer.

5) 4 - Steel Wedges: Weld to sleeve at 90-degree angles to the center of the flagpole.

6) 4- Hardwood Wedges.

7) Sealant shall be polyurethane joint sealant as specified in Section 03400 Site Concrete.

d Pole shaft and pole flash color finish shall be the manufacturer's standard finish such as, deep luster finish.

e Fittings and Accessories

1) Truck shall be a cast aluminum, internal halyard type, revolving, non-fouling.

2) Halyard shall be concealed internal halyard system with stainless steel cable sized to accommodate the specified maximum flag size, 2 swivel-snaps, counter weight, and retainer ring.

3) Winch shall be mounted inside the pole and protected by a locked door.

2.07 BENCH (12 total)

A Acceptable Manufacturers: Provide products which meet or exceed the requirements of these specifications from one of the following manufacturers.

1 Scarborough bench, 72” length with back, arms and center arm. Landscape Forms. 800-381-3455. Aluminum polyester powdercoat. Color to be selected from standard color chart by the Architect, manufactured by Landscape Forms, 800-381-3455.

2 Winchester, rod, 72” length with back and arms, surface mount. Powdercoat aluminum from standard color chart by the Architect as manufactured by Urbanscapesfurniture.com.

3 Persidio straight three-unit bench, no arms, 69” length with back, embedded, by Landscape Forms. 800-381-3455. Aluminum polyester powdercoat. Color to be selected from standard color chart by the Architect, manufactured by Landscape Forms, 800-381-3455.

B Manufacturing Requirements: Provide benches as complete units produced by the same manufacturer.

PART 3 - EXECUTION

3.01 TRASH AND RECYCLING RECEPTACLE

A Installation shall be surface mounted as recommended by the manufacturer.

B Provide touch up paint as necessary to match the manufacturers.

3.02 BENCHES

A Assembly and installation shall be per the manufacturer’s instructions and as specified herein.

B Install embedded items into the paving surface and install the bench as per the manufacture’s instructions.

C Use manufacturer’s provided paint for touching up all chips and scratches.

3.03 BICYCLE RACK

A Installation shall be as shown on the drawings and as specified by the manufacturer an as specified herein.

B The bicycle rack shall be installed plumb and set to the grade(s).

C Provide touch up paint as necessary to match the manufacturers.

3.04 DECORATIVE GRAVEL

A Installation shall be as shown on the drawings.

3.05 FLAGPOLE

A Installation shall be as per the manufacturer’s instructions, as shown on the shop drawings and as specified herein. The goal, flagpoles and cage shall be plumb and set to the grades shown on the drawings.

B Excavation for footings, backfill and compaction shall be as specified in Site Grading and Excavation.

C Install the concrete footing as specified in Cast in Place Concrete.

END OF SECTION

SECTION 32 9000

PLANTING

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

A Work Included: Provide all labor, materials, equipment, services and transportation required to complete planting work as shown on the Drawings and as specified herein or both.

B Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.

1 Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

1.03 RELATED WORK

A The following Work to be performed under the designated Sections:

1 Earthwork - Section 31 2000
2 Finish Grading - Section 31 2219
3 Soil Preparation - Section 32 9113
4 Landscape Maintenance - Section 31 0125

1.04 REFERENCES

A "American Standard for Nursery Stock", 1986 Edition, American Association of Nurserymen, Inc.

1 The Contractor shall have a copy of this with him for all nursery visits and on site at all times.

B "Hortus III", 1976 Edition, Bailey Hortorium, Cornell University.

C "Arboriculture", Harris, R.W., Prentice Hall, Inc., New Jersey, 1983.

1.05 SUBMITTALS

A Submit the following in accordance with the provisions of Section 01 3300 – Submittals.

B Plant Materials Review

1 Within 30 days after the Award of the Contract, the Contractor shall submit a complete list of all plant materials proposed. The list shall include: Scientific names of plants, size and quantity of plants available for review, location of growing grounds or nursery, and the suppliers name, phone number, address, and contact person.

a The Contractor shall also submit at this time color photographic prints of each plant proposed. A scale element or person of a known height shall appear in each photograph.

b The Contractor shall also submit at this time attached Letter(s) of Certification from each nursery or the supplier listing the stock available for review attesting that the stock to be reviewed for selection is the specified plant stock meeting all the sizing and all other specified requirements and that these plants are free from disease, insect infestation or damage.

2 **Substitutions: There will be no substitutions for the plants, plant species and variety.**

3 Field Collected Plant Material: If the contractor finds that some plant materials are only available from non-nursery sources, the Landscape Architect will consider whether these can be used in the work. The Contractor shall submit written data, the same as for Unavailable Material, listing all nurseries and sources he contacted.

a All conditions specified under Unavailable Material not changed by this item shall apply for substitutions and larger and smaller plants.

b If the Landscape Architect elects to consider these plants, all requirements for nursery grown plants shall apply.

4 The Landscape Architect based upon his review of the plant photograph submission(s) will determine if, in his judgment the plants are acceptable for field review at the nursery.

a The Landscape Architect reserves the right to provisionally accept the plant material from the photograph without his inspection at the nursery if he deems it is in the best interest of the project to do so.

1) If these provisionally accepted plants do not meet the requirements of this specification in the opinion of the Landscape Architect when he reviews them on site prior to planting, the Contractor shall remove them from the site at no additional cost to the Owner and immediately

find replacement plants which meet the requirements of this Specification. The Contractor will then arrange for plant review as specified herein.

b The Landscape Architect may field review and tag all acceptable proposed plant materials at the nursery. Such approval shall not impair the Landscape Architect's right of inspection and rejection of any plants at any time during the progress of the work which do not meet the requirements of this Specification.

5 Nursery Inspection: The Contractor shall accompany the Landscape Architect to all reviews of plant materials at the nursery. The Landscape Architect may review and tag plants at place of growth and upon delivery to the site (if he wishes) for conformity to the Specifications.

a The Landscape Architect's acceptance of the plants at this time shall not impair his right of inspection and rejection of any plants at any time during the progress of the work which do not meet the requirements of the Specifications.

b The Contractor shall have a copy(s) of the specified Planting Digging at the Nursery to give to each Nursery from which plant material is purchased.

1) The Contractor shall explain these requirements to each Nursery and Identify the required Nursery or Growers Written Certification.

6 If the plant material at the nursery(s) in found to be unacceptable in the opinion of the Landscape Architect, the Contractor shall at his expense find the plants required and arrange with the Landscape Architect’s review of the plant material.

a This sequence of plant finding, review and approval or rejection and review again for approval shall continue until all plants have been accepted by the Landscape Architect.

7 The Contractor shall be solely responsible for the purchase of the accepted plant materials from the supplier or nursery.

8 Special Conditions: The above provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

B Product Data: Manufacturer's current catalog cuts and specifications of the following:

1 Mulch

2 Top dress fertilizer

3 Fertilizer tablets.

4 Anti-desiccant.

5 Jute mesh.

C Samples

1 Fertilizer tablets.

2 Mulch: One (1) pint.

D Certificates

1 Nursery or Grower's Written Certification (s) of Root Crown (flare exposure).

2 Written Certification from the Grower and Contractor that the plants are true to species and variety.

E Tests

1 Plant Pit Percolation Tests

1.06 DELIVERY, STORAGE, AND HANDLING OF PLANT MATERIALS

A Delivery: Deliver, store and handle materials to the site in such a way that they will not be damaged. Do not deliver to the site disease-infected plant materials.

B Labeling: Provide legible waterproof labels for all plants and attach them at the nursery. The labels shall have the correct genus and species and Common Name and the name of the grower or nursery form, which it was purchased.

C Certificates of Inspection: As required by law for transportation of each shipment of plants along with invoice.

D Storage: Protect containered plants from sun during summer months with temperatures above 80 degrees F. Keep plants that cannot be planted immediately upon delivery in the shade, well protected and well watered.

E Handling

1 Do not lift or handle plants by tops, stems or trunk at any time. Do not pull or bend or handle plants with wire (except wrapped rootball of field dug plants).

2 Lift plants by supporting rootball bottom or container bottom.

3 Do not throw or drop any plants from trucks or other equipment.

4 Any damaged plants including plants with broken balls or cracked containers will be rejected and immediately replaced with matching plants.

F Anti-Desiccant: At Contractor's option, and immediately before transporting, spray deciduous plant materials in full leaf or evergreens with anti-desiccant. Apply an adequate film over trunks, branches, twigs and foliage.

1.07 PLANT DIGGING AT THE NURSERY

A All overburden soil, if any is present, shall be removed from all tree and shrub rootballs prior to digging.

1 The depth of this overburden soil shall be determined by excavating down at the plants trunk(s) until the root flare is exposed.

a The root crown (flare) is the point at which the roots begin to flare out from each plants trunk(s)

b The Contractor shall not accept any plants for shipping which have not had all overburden soil removed and root balls of the incorrect sizes.

c The Landscape Architect will reject any plants which have overburden soil unremoved and rootball(s) of incorrect sizes.

d The rejected plants shall be immediately replaced by the Contractor with matching specified plants at no additional cost to the Owner.

B Field Dug Stock:

1 Prior to digging of field grown plant materials, insure that excess loose fill resulting from cultivation around stems and over roots be removed down to natural finish grade at crown of plant materials. During digging, verify that size of tree spade or other equipment is adequate to encompass the actively growing root zone of all plants. Plants, which, after digging, show mostly large fleshy roots and few fibrous roots, will be rejected.

2 Dig B&B plants with firm, natural balls of earth of diameter not less than that recommended by the American Standard for Nursery Stock, and of sufficient depth to include the fibrous and feeding roots. Wrap and tie as required to prevent all cracking or loss of soil from routable.

C The Contractor shall inspect all plants at the Nursery after digging and prior to shipping and shall determine that they meet all the requirements of these Specifications and reject any that do not.

1 The Contractor shall immediately provide replacement plants meeting these Specifications that match those rejected at no additional cost to the Owner.

1.08 SEQUENCING AND SCHEDULING

A The following sequencing and scheduling is general only and does not list all the items of work:

1 Refer to Section 32 91 13 Soil Preparation PART 3 INSTALLATION for scarification, subsoil amending, where shown on the Drawings, plant backfill mix (on grade) requirements and other requirements.

a On-Grade Planting Sequencing

1) Rough grading
2) Scarification
3) Layout trees and shrubs for approval
4) Excavate plant pits and beds
5) Test Tree Pits for drainage
6) Amend Subsoil (if required by the approved Soil Tests)
7) Install and amended plant backfill mix
8) Finish Grade
9) Plant materials installation
10) Fine grade and repair plant saucers

B Coordination: Coordinate with work of other sections to insure the following sequence of events:

Pruning: Do not prune plant materials until after installation.

C Planting Seasons: All plant material shall be planted during the Spring or Fall planting season as indicated below. No planting shall be performed in frozen ground or when snow covers the ground. The Landscape Architect may suspend work when soil or weather conditions are unsuitable for planting operations.

1 Deciduous Trees and Shrubs which are Balled and Burlapped and or Container Material, and Evergreen Shrubs which are Container Material

Spring: March 1 to June 15
Fall: September 1 to December 1

2 Evergreen Shrubs that are Balled and Burlapped:

Spring: April 1 to May 15
Fall: August 15 to October 30

3 Evergreen Trees:

Spring: April 1 to May 15
Fall: August 15 to October 30

4 Special Conditions: If special conditions exist which may warrant a variance in the above conditions or dates, a written request shall be submitted to the Landscape Architect stating the conditions and proposed variance. Permission for the variance shall be given if in the opinion of the Landscape Architect if the variance is warranted.

1.09 WARRANTY

A Warrant that all plants (except annuals) planted under this Contract will be healthy and in flourishing condition of active growth one (1) year after the date of Acceptance of the 90 Day Maintenance.

B Correct Species: Warrant that all plant materials are true to species and variety.

C Delays: Delays caused by the Contractor in completing planting operations which extend the planting into more than one planting season shall extend the Warranty Period correspondingly.

D Condition of Plants: Plants shall be free of dead or dying branches and branch tips, with foliage of normal density, size and color.

E Replacements: As soon as weather conditions permit, replace, without cost to Owner all dead plants and all plants not in a vigorous, thriving condition, as determined by Landscape Architect during and at the end of Warranty Period.

F Exclusions: Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, and acts of God, during Warranty Period. Report such conditions.

1.10 MAINTENANCE AND PROTECTION OF PLANTS UNTIL THEIR ACCEPTANCE AT THE PRELIMINARY REVIEW

A Maintenance shall begin immediately after the installation of each plant.

1 Refer to Section 31 0125 Landscape Maintenance for requirements.

1.11 90 DAY MAINTENANCE PERIOD AND FINAL ACCEPTANCE

A Refer to Section 31 0125 Landscape Maintenance for these requirements.

1.12 REPLACEMENTS

A Failed Materials

1 Replace at no cost to the Owner all plant materials exhibiting conditions which are determined as unacceptable by the landscape architect.

2 Replacements shall be the same species. Apply all requirements of this Specification and drawings to replacements.

3 Contractor shall be held responsible for a maximum of one (1) replacement for each failed tree, shrub and vine, and same area of groundcover planting after final acceptance during warranty period.

B Incorrect Materials

1 During Warranty Period, replace at no cost to Owner plants revealed as being untrue to name and species.

2 Provide replacements of a size and quality to match the planted materials at the time the mistake is discovered.

1.13 DEFINITIONS

A References to Landscape Architect shall mean Architect or the Architect's designated representative.

PART 2 – PRODUCTS

2.01 MATERIALS

A Plant Materials

1 Verify that all container stock (excluding annuals) has been grown in the containers in which delivered for at least one growing season, but not over two (2) years.

2 Growing Conditions: Plants shall be nursery-grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least two years unless otherwise specifically authorized.

3 Appearance: Trees and shrubs shall be exceptionally heavy, symmetrical (as applicable to the species), tightly knit, and so trained or favored in development and appearance as to be superior in form for their species, with regard to number of branches, compactness and symmetry and other applicable standards specified in the American Standard for Nursery Stock for the species and size of plants in the Contract.

4 Vigor: Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae. They shall have healthy, well-developed root systems. Plants shall be free from physical damage or adverse conditions which would prevent thriving growth.

B Condition of Root System: Samples must prove to be completely free of circling, kinked or girdling trunk surface and center roots and as applicable show no evidence of a pot-bound condition. Upon inspection by Landscape Architect at the job site, if five (5) percent or more of the plants of each species are found to contain kinked, circling or girdling roots, all plants of that species will be rejected.

C Measurements

1 Refer to the American Standards for Nursery Stock for applicable standards not specified herein.

2 General: Take caliper measurement at a point on the trunk 6 in. above natural ground line for trees up to 4 in. in caliper (and at a point 12 in. above the natural ground line for trees over 4 inches in caliper.)

a Measure foliage across mean foliage dimension when branches are in their normal upright position. Foliage origin along main trunk shall be measured from soil line.

b Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Properly trimmed plants shall measure the same in any direction. If a plant is unevenly grown, it shall be classified in the size category of the smallest dimension.

3 Size Range: If a range of size is given, do not use plant materials less than the minimum size. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected.

4 Substitutions

a Refer to SUBMITTALS of this Section - 32 9000 Plant Materials, for Substitution requirements.

D Unacceptable Trees: Trees having such items, as but not limited to, the following will be rejected:

1 Nonconformance to the specifications.

2 Damaged or crooked leaders or other damage.

3 Main leader headed back.

4 Abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 3/4 inch diameter which have not completely callused.

5 Plant disease, nutrient or other stress.

E Pruning: Do not prune plants until after installation. See Section 31 0125 - Landscape Maintenance for time of pruning, pruning requirements, and review at the time of pruning by the Landscape Architect.

F Refer to Item 1.06 PLANT DIGGING AT THE NURSERY of this Section - 32 9000 Planting for other applicable plant material requirements.

2.02 MIXES

A Backfill Mix for Plant Pits: See Section 32 9113 - Soil Preparation.

2.03 ACCESSORIES

A Pine Bark Mulch:

1 Pine bark mulch shall be derived from evergreen tree bark aged a minimum of (6) months and no more than (18) months. The bark shall be shredded so that the resulting pieces are no more than (1/4) inch thick and no longer than (3) inches. The mulch shall be free of stringy materials and shall not contain an excess of fine particles. The mulch shall be dark brown in color, free of leaves, twigs, sod, weeds, shavings, and other foreign materials which are injurious to healthy plant growth.

B Water

1 Clean, fresh and potable.

2 Transport as required.

C Anti-Desiccant: (Used for retarding excessive loss of plant moisture and inhibiting wilt)

1 Type: Sprayable, water-soluble vinyl-vinyledine complex which will produce a moisture-retarding barrier not removable by rain or snow.

2 Product "transfilm" by P.B.I./Gordon Corporation, (816) 421-4070, or equal.

2.04 COMMERCIAL FERTILIZER TABLETS

A Commercial Fertilizers for Trees, Shrubs and Vines shall be Slow-release Fertilizer Tablet: "Agriform" 21 gram tablets with 20-10-5 (N-P-K) by Sierra Chemical Co., (408) 263-8080, or equal.

2.05 PROTECTIVE COVERINGS

A Product: Refer to Section 31 2500 – Erosion Control for jute mesh.

PART 3 – EXECUTION

3.01 EXAMINATION

A Verification of Conditions

1 Finish Grades: Finish grades for planting areas shall have been established in another Section. Verify that all grades are within 1 in. plus or minus of required finish grade.

2 Soil Preparation: Do not commence planting work prior to completion and acceptance of soil preparation. See Section 32 9113 Soil Preparation.

3.02 LAYOUT

A Layout and Staking: Lay out plants at locations shown on Drawings. Use (3) foot lath, or wire flag, color-coded for each specie of plant material.

3.03 LANDSCAPE ARCHITECTS FIELD REVIEW OF PLANT AND PLANT BED LOCATIONS AND CONFIGURATIONS

A Locations of the Contractor's stakes and plant bed layout will be checked in the field by the Landscape Architect with the Contractor and will be adjusted by the Contractor to the Landscape Architects satisfaction to exact position before planting begins. Right is reserved to refuse review at this time if, in the Landscape Architect's opinion, an insufficient quantity of plants is available to be planted.

3.04 DIGGING PLANT PITS AND PLANT BEDS

A Digging Plant Pits: Dig tree pits only after the finished subgrade has been approved as shown on the Drawings and described herein. For on grade trees scarify all sides and bottoms of the tree pit after excavation and do any on grade subgrade amending required by the Soils Testing Report.

B Shrub pits and beds and Groundcover and perennial beds shall be dug only after the finished subgrade has been approved as shown on the Drawings and described herein. For on grade pits and beds, scarify the beds' sides and bottoms and do any on grade subgrade amending required by the Soils Testing Report.

C Containerized Plant Pits: Excavate round plant pits as shown on the Drawings:

D Ball and Burlap Plant Pits: Excavate round plant pits as shown on the Drawings:

3.05 OBSTRUCTIONS IN PLANT PIT(S) OR PLANTING BED(S)

A Obstructions: If rock, underground construction work, main tree roots or other obstructions are encountered in the excavation of the plant pits which may not be able to be removed or are the work of others, the Contractor shall stop digging that pit or bed and immediately contact the Landscape Architect with a full written explanation of the nature of the obstruction.

1 The Landscape Architect will determine if the object(s) encountered are such that they can be removed.

a If the Landscape Architect determines that the object (s) could be removed, the Contractor shall submit a proposal for the Landscape Architects and the Owner's review consideration for approval for the cost of the object(s) removal prior to doing any work.

b If the object can not be removed or the cost is too much to remove, as determined by the review of the Owner, and the Landscape Architect. The Landscape Architect will either select an alternate location for the plant pit plant bed location(s), or plant bed configuration(s), or he will require a credit from the Contractor for the Plants not installed.

1) If the Landscape Architect determines that an Alternative location for the plant can be done, the Contractor will submit his costs for the plant pit or plant bed work done to the point of finding the obstruction and the cost for backfilling the pit, and or, the plant bed to meet the requirements of the work and any additional requirements as determined by the Landscape Architect.

3.06 DRAINAGE TEST(S) OF PLANT PITS FOR TREES, SHRUBS, AND GENERAL PLANT BED TESTS FOR EACH GROUNDCOVER AND PERENNIAL BED

A Plant Percolation tests for Trees not underdrained.

1 10 Tree pit shall be tested in areas selected by the Landscape Architect.

2 Tree Pit Testing Procedure

a Dig test pit the size specified for each tree pit. Legibly calibrate a stake at (1) inch intervals into the bottom of the pit.

b Fill the test pit with water to within (1) foot of the finish grade. Immediately record the water level on the stake.

c After 3 hours, record the water level again. Repeat recording of the water level once each hour for the succeeding 5 hours.

d Water level drop ratings:

1) Acceptable rate = 2 inches /hour or more

2) Marginal rate = 1 to 2 inches/ hour

3) Unacceptable rate = Less than 1 inch / hour

3 Shrub and Groundcover and perennial beds: For each shrub or groundcover bed dig and test four on-grade pits sized for each plant species in each bed at location(s) as determined by the Landscape Architect in the field.

a Locate a water measure stick marked the same as for tree pits in each pit to be tested.

b Water level drop ratings shall be recorded the same way as noted for tree pits.

4 Test all plant pits twice in succession.

5 Written test results

a Provide a list of all water drop levels for all plant pits tested.

b Provide written notification of conditions permitting the retention of water in plant pits for more than 24 hours and provide the location of these pits and all other tested pits on a plan.

6 Restrictions: Do not perform tests of a rainy day (or during freezing weather) of when the ground is frozen or the soil is saturated with water. Repeat all tests interrupted by water soil saturation, rain, frozen ground, and freezing temperatures.

7 Documentation: Submit written documentation of all test pit percolation results, dated and signed by the tester.

a The Landscape Architect will determine which pits are acceptable for planting.

b The Landscape Architect will determine if the plant(s) pits or plant beds

can be relocated to an area that does not require underdrainage, or if they can not be relocated and not could be acceptably underdrained in place, or if they can not be acceptably underdrained the Landscape Architect will request a credit for the applicable plants as specified.

c Plant Relocation Option

1) If the Landscape Architect determines that the plants(s) could be relocated to an area that drains, the Landscape Architect will select the area(s)for relocation. The Contractor shall submit a proposal for the Landscape Architects and the Owner's review consideration for approval for the cost of the object(s) removal and relocation prior to doing any work.

2) If the plant can not be relocated or the cost is too much to relocate AS DETERMINED BY REVIEW OF THE OWNER AND THE LANDSCAPE ARCHITECT, the Landscape Architect will require a credit from the Contractor.

d Plant Underdrainage in Original Location Option

1) If the Landscape Architect determines that the plant should remain in place if it can be underdrained in a manner that the cost is acceptable to the Owner, the Landscape Architect and the Contractor will discuss underdrainage options. The Landscape Architect will consider these options and prepare any of these or other options for the Contractor to price to correct the need for underdrainage. The Contractor shall submit the pricing for the Landscape Architect's and the Owner’s review and consideration for approval before doing the work.

2) If the Cost is too much in the opinion of the Landscape Architect and the Owner, They will consider other options and the Contractor's Recommendations to resolve the underdrainage issue They will inform the Contractor of their conclusions for him to price for his incorporation into the work, or they will request a credit from the Contractor.

3.07 TREE SHRUB AND VINE PLANTING

A Handling and De-potting of Plant Materials

1 Damage: Avoid damage to containerized root masses and rootballs. If rootball or containerized root mass is cracked or broken or the trunk loose in the ball or container during handling and de-potting, plant will be rejected. Do not remove plant from container prior to completion of plant pit preparation.

2 Containerized Plants

a Canned Shrubs: Metal Containers: Cut can on two sides with accepted cutting tool. Do not use spade.:

b Plastic Containers: Tip container to horizontal orientation and shake carefully to remove the root mass and the plant. Support rootball and the root mass during installation to prevent cracking or shedding of soil.

3 Balled and Burlapped Plants: Lift and carry by bottom of the root ball or containerized root mass only. Do not remove wrapping until plant is set in plant pit. Cut all wire and peel wire and wrapping away from upper 1/3 of rootball prior to backfilling.

a Plastic or otherwise indecomposable burlap or other undecompostable root ball covering materials shall not be used.

B Installation

1 Refer to the Drawings for the planting details and locations for the plants.

2 Containerized Root Mass Scarification

a After removing plant and its containerized root mass from the container, scarify the sides of the rootball to a depth of 1 in. at four to six equally-spaced locations around the perimeter of the root mass or at 12 in. intervals on sides of boxed materials. Cut and remove circling roots over 3/8 in. diameter.

b Shrub and Vine Pit Depths: Confirm the depth of each shrub and vine pit by setting the root crown 1- inch above the finish grade as shown on the Drawings.

1) If any pits are over excavated, add and foot or hand tamp compact backfill mix at the bottom of the pit or bed to correct the level of over excavation.

3 Plant Pit Side Scarification: Scarify sides of plant pit, thoroughly breaking up surfaces and eliminating "glazed" areas.

4 Tree Shrub and Vine Positioning: Position the plant in the planting bed and or pit as shown on the Drawings maintaining a plumb condition throughout all planting operations.

5 Tree Shrub and Vine Pit Depths

a Shrub and Vine Pit Depths: Confirm the depth of each shrub and vine pit by setting the root crown 1- inch above the finish grade as shown on the Drawings.

1) If any pits are over excavated, add and foot or hand tamp compact backfill mix at the bottom of the pit or bed to correct the level of over excavation.

b Confirm the depth of each tree pit and if any are over excavated install the Tree Pit Leveling Mound. Backfilling with any other material to correct the excavation depth will not be acceptable.

1) Install the topsoil as the leveling mound as shown on the Drawings and Compact the fill to 85 % density.

4 Plant Positioning: Position as shown on the Drawings. Backfill plant pit to allow setting crown of tree (2) inches above new finish grade and crown of shrub 1 in. above finish grade. Maintain throughout all planting operations.

a Plant Pit or Bed Backfilling

1) Use backfill mix to backfill on-grade plant pits as shown on Drawings. Brace each plant plumb and rigidly in position until the backfill mix has been tamped solidly around the ball and roots.

a) Shrub pits that are underdrained shall have a compacted backfill mix layer installed over the entire shrub bed as shown on the Drawings.

2) When plant pits and plant beds have been backfilled approximately 2/3 full, water thoroughly and saturate rootball or containerized root mass, before installing remainder of the backfill mix to top of pit, eliminating all air pockets. The compaction method shall be the same as described above in the previous item.

a) The Contractor shall exercise particular care to be certain that no backfill mix is placed on top of the rootball or containerized root mass. Also see planting details for incorporation of items noted there.

b) Addition of Slow-Release Fertilizer Tablets: When the plant pits and beds are backfilled to 2/3's of their depth. Locate the number of tablets per plant as recommended below, unless stated otherwise by the approved tablet manufacturer, and place the number of tablets required adjacent to each plant's rootball or container root mass for the specified trees, shrubs, and vines as scheduled below:

Container Stock

1 gallon can - 2 tablets
5 gallon can - 4 tablets

B & B stock:

1 tablet per 1/2 in. caliper or
1 ft. of height, whichever is less

3) Continue backfilling plant pits and beds to their full depth with backfill mix.

4) Watering Basin: Form a circular saucer around each tree, shrub, and vine of backfill mix as shown on the Drawings.

5) All Plants shall be plumb after the backfill mix has been installed.

c Watering: Immediately water all plants after completion of planting operations.

3.08 TREE, SHURB, AND VINE PRUNING

A See Section 31 0125 - Landscape Maintenance.

1 All pruning shall be done at the time of the Preliminary review unless otherwise requested by the Landscape Architect.

3.09 TREE SHRUB AND VINE MULCHING

A Install a layer of mulch over all shrub and annual beds or areas and also all tree and shrub watering basins and beds to the depth(s) and where as shown on the Drawings.

3.10 GROUNDCOVER PLANTING

A Remove groundcover plants from containers and flats. Care shall be taken not to strip the roots from any of the plants.

B Plant groundcover as shown on the Drawings, and cover the roots completely. Do not bury the Groundcover Plant Leaves.

C Watering: Immediately water groundcover areas after planting and correct any settlement of the amended topsoil by removing the affected plants by adding supplemental backfill mix and removing the affected groundcover plants and replanting.

D Ground Cover Bed Mulching

1 Install mulch over the ground cover bed after it has been spaced and planted to the proper planting depth and where and as shown on the Drawings.

a Care shall be taken not to cover any plants or plant leaves with mulch.

E Watering: Immediately water groundcover areas and similarly correct any settled plants.

1 Water as necessary to keep the groundcover in flourishing and healthy condition.

3.11 VINE PLANTING

A Plant vines the same as shrubs and as shown on the drawings.

1 Install fertilizer tablets according to the manufacturer's direction for each vine.

B Water immediately and correct any settlement by removing and replanting the plants after adding additional backfill mix to correct the settlement and replanting the plants to the required height.

1 Water as necessary to keep the vines in flourishing and healthy condition.

C Install mulch to the depth and where shown on drawings.

3.12 PROTECTIVE COVERINGS

1 Install jute mesh as specified in Section 31 2500 – Erosion Control over shrub beds in areas where Meadow Mix is installed.

3.13 MAINTENANCE AND PROTECTION OF NEW PLANTING, AND MATERIALS UNTIL ACCEPTANCE OF THE PRELIMINARY REVIEW

A See Section 31 0125 - Landscape Maintenance.

1 The Maintenance for New Panting shall be as specified in PART-3 EXECUTION of Section 31 0125 for Trees, Shrubs, Groundcovers, Perennials and Annuals.

a This Maintenance shall begin immediately after each plant and or material is installed.

3.14 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 to the satisfaction of the Landscape Architect.

END OF SECTION

SECTION 32 9200

LAWNS AND GRASSES

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

A Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to complete lawns and grasses as shown on the Drawings and as specified herein or both.

B Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.

1 Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

1.03 RELATED WORK

A Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division One of these specifications.

1 Finish Grading - Section 31 2219
2 Earthwork - Section 31 2000
3 Soil Preparation - Section 32 9113
4 Planting - Section 32 9000
5 Landscape Maintenance - Section 31 0125
6 Site Concrete – Section 32 1313
7 Landscape Subdrainage – Section 33 4610

1.04 REFERENCES

A Hortus III - 1976 Edition, Bailey Hortorium, Cornell University.

1.05 SUBMITTALS

A Product Data:

1 Manufacturer's current catalog cuts and specifications for incorporating mulch and soil stabilizer for hydroseed mix.

2 Grass Seed for Lawn Areas.

3 Athletic Field Seed Mix

4 Meadow Grass Seed Mix

5 Jute Mesh.

6 Seeding device for Cultipactor Seeding

B Certificates:

1 Certificates of inspection as required by law for transportation of each shipment of seed along with invoice.

2 Seed mix certificate confirming the grasses and their minimum percent grass seed purity and germination (including incorporated top dress fertilizer and rate of application for hydroseeding and meadow mix).

C Samples:

1 One pint each of hydroseeding mulch and soil stabilizer.

1.06 DELIVERY, STORAGE, AND HANDLING

A Seed:

1 Delivery: Furnish standard seed in unopened manufacturer's standard containers bearing original certification labels showing quantity, analysis and name of manufacturer.

2 Storage: Protect seed from weather or other conditions that would damage or impair the effectiveness of the product.

B Hydroseeding Mulch:

1 Labeling: Each package of cellulose fiber shall be marked by the manufacturer to show the air-dry weight content.

2 Storage: Protect from weather or other conditions, which would damage or impair the effectiveness of the product.

1.07 CLIMATE RESTRICTIONS

A Do not install lawns during rainy or freezing weather, or when soil is frozen.

1.08 TIMING OF INSTALLATION

A Hydroseeded Lawns and Cultipactor Seeding:

1 Hydroseeding shall be done within one (1) calendar days after the completion and acceptance of finish grading in any area.

2 Hydroseeding of Lawns & Cultipactor Seeding of Detention Areas and Meadow Mix :

Between April 1 - May 31 and
Between August 15 - October 1.

3 Athletic Fields and Meadow Grass (Cultipactor Seeded only):

Between July 1 and October 15.

4 If special conditions exist which may warrant a variance in the above dates, a written request shall be submitted to the Landscape Architect stating the conditions and proposed variance. Permission for the variance shall be given if in the opinion of the Landscape Architect the variance is warranted.

1.09 WARRANTY

A Time Period: Warrant that lawns and grasses shall be in a healthy and flourishing condition of active growth until acceptance by the Landscape Architect of the 90 Day Maintenance Period.

1 Refer to Section 31 0125 Landscape Maintenance Part 3 Execution for lawn maintenance requirements until and during the 90 Day Maintenance Period.

B Appearance During Warranty: Lawns and grasses shall be free of dead or dying patches, disease, and all areas shall show foliage of a normal density, size and color.

1 The flourishing grass coverage for the lawns and grasses shall mean that a minimum of 95% of the area planted shall be covered with the specified grasses by the end of the 90 day maintenance period in order to qualify for the acceptance of the 90 day maintenance period.

C Delays: Delays caused by the Contractor in completing planting operations which extend the planting into more than one planting season shall extend the Warranty Period correspondingly.

D Coverage: Warrant growth and coverage of hydroseeded areas to the effect that the area planted shall be covered with vigorous well established lawn weed free with no bare spots.

E Exceptions: Contractor shall not be held responsible for failures due to damage by Owner, vandalism, or Acts of God during Warranty Period. Report such conditions in writing.

1.10 INSPECTIONS:

A Landscape Architect reserves the right to inspect seed mixes and the hydroseed accessories upon delivery to the site and to reject any or all of the shipment if it does not meet his satisfaction.

1.11 DEFINITIONS

A References to Landscape Architect shall mean Architect or the Architect's designated representative.

1.12 MAINTENANCE AND PROTECTION OF NEW LAWNS AND GRASSES UNTIL THEIR ACCEPTANCE AT THE PRELIMINARY REVIEW.

A The Contractor's Maintenance of Lawns shall begin as soon as each lawn area is hydroseeded and shall continue until acceptance by the Landscape Architect at the Acceptance of the 90 Day Maintenance Period.

B Maintenance shall begin immediately after the installation of each lawn area.

1 Refer to Section 31 0125 Landscape Maintenance PART 3 - EXECUTION for requirements.

PART 2 – PRODUCTS

2.01 SEED MIXES:

A Seed Mix Uses: Use where shown on the Drawings.

Seed Composition: Use only fresh, clean, certified, new crop seed of the following varieties mixed in the following proportions:

B LAWN SEED MIX TABLE:

1 GRASS SEED MIX FOR HYDROSEEDED LAWNS:

Seeding Rate: 170 lbs/acre or 4 lbs per 1,000 square feet.

SEEDS	SEED MIX PROPORTION (by weight)	PURITY MIN. (by weight)	GERMIN. MIN.
Fine Fescue	40%	Latest Crop	Current Standard
Kentucky Bluegrass	40%	Latest Crop	Current Standard
Perennial Rye Grass	20%	Latest Crop	Current Standard
Total Mix:	100%		

a Kentucky Bluegrass and Fine Fescue shall consist of a minimum of 2 cultivars.

2 ATHLETIC FIELDS SEED MIX (Cultipactor Seeded):

Seeding Rate: 260 lbs/acre or 6 lbs/1,000 square feet.

SEEDS	SEED MIX PROPORTION (by weight)	PURITY MIN. (by weight)	GERMIN. MIN.
Perennial Rye Grasses	20%	Latest Crop	Current Standard
Kentucky Blue Grasses	80%	Latest Crop	Current Standard
Total Mix:	100%		

a Perennial Rye Grasses shall consist of a minimum of 2 cultivars such as Palmer II, Prelude II, or Repell II.

b Kentucky Bluegrass shall consist of a minimum of 3 cultivars.

C MEADOW GRASS MIX (Cultipactor Seeded only):

1 Seed: New England Wildflower Mix as available through New England Wetland Plants Incorporated, 413-548-8000 or approved equal

2 Seeding Rate: 23 pounds per acre.

2.02 SEEDING ACCESSORIES

A Water: Potable water. Transport as required.

B Hydroseeding Mulch:

1 Composition: Green-colored, fibrous, 100% virgin wood fiber mulch containing no growth or germination-inhibiting factors.

2 Weight: Weight specification refers only to air dry weight of the fiber material. Absolute air dry weight is considered equivalent to 10% moisture.

3 Dispersion in Slurry: Mulch shall be manufactured in such manner that after addition to and agitation in slurry tanks with fertilizer, seed, water and other approved additives, fibers in the material will become uniformly suspended to form a homogeneous slurry.

4 Absorption Capacity: When hydraulically sprayed on the ground, the material will form a blotter-like groundcover impregnated uniformly with seed, which will allow the absorption of moisture and allow rainfall to percolate to the underlying soil.

5 Product: "X-100 Spra-mulch" by Pacific Wood Fibers (253) 885-1341, or "Conwed Fiber" by Conwed Corporation (704) 871-8500 or equal.

C Hydroseeding Soil Stabilizer:

1 Composition: Totally organic substance, supplied in powder form and at least 90% of which is 92% pure muciloid derived from ground Plantago ovata-insularis husks. Stabilizer shall be water-soluble, non-toxic hydrophilic and shall not inhibit germination.

2 Product: "Ecology Controls M-binder" by Ecology Controls, (213) 877-8600, "R-Binder" by Clyde Robin Seed Co., (415) 785-0425, or equal.

2.03 HYDROSEEDING EQUIPMENT

A Type: Commercial hydro-seeder with built-in agitation system and an operating capacity sufficient to agitate, suspend and homogeneously mix slurry.

B Distribution Lines: Sufficient to prevent stoppage and provide even distribution of the slurry over the ground.

C Pump Capacity: 150 minimum psi at the nozzle.

D Slurry Tank: 1,000 gallons minimum capacity.

2.04 PROTECTIVE COVERINGS

A Product: Refer to Section 02270 – Erosion Control for jute mesh.

2.05 CULTIPACTOR SEEDING DEVICE

A Machine Pulled Equipment: Cultipactor Seeding equipment or other approved seeding equipment which will successfully seed the seed mixes specified for the Seeding Device.

B Brillion Seeding Device or other approved seeding equipment for areas not accessible to the machine pulled equipment for the seeding mixes.

PART 3 – EXECUTION

3.01 EXAMINATION FOR LAWN INSTALLATION

A Verification of Conditions:

1 Grades: Verify that grades are within (1) inch plus or minus of the required finished grades. Verify that all soil preparation has been completed and approved. Report all variations in writing.

2 Soil Preparation Work: Verify that all fertilization amending and scarification specified in Section 32 9113 has been completed before any seeding work in Lawn Areas or Meadow Mix Seed Areas shall be done.

3.02 PREPARATION

A The seed bed shall be raked either by power rake or by hand to produce a loose friable seed bed.

B Stones, Weeds, Debris: Verify that all areas to receive lawns grasses are clear of stones larger than (1/2) inch in any dimension, weeds, debris and other extraneous materials shall be removed.

1 Remove and legally dispose any of these materials at no additional cost to the Owner.

C Excessive Soil Moisture: Do not commence work of this Section when soil moisture content is so great that excessive compaction will occur.

D Inadequate Soil Moisture: Apply water, as necessary, to bring soil to an optimum moisture content for planting. Do not work soil when it is so dry that dust will form in air or that clods will not break readily.

E Care shall be taken that no lime, fertilizer, hydroseed mulch or seed mix comes in contact with the adjacent planting areas.

3.03 LAWN INSTALLATION

A Areas for Lawn Seed are designated and shall be where located on the Drawings and are listed below:

1 Lawn Seed Mix for Hydroseeded Lawns: This mix shall be for hydroseeded lawns.

2 Athletic Field Lawn Seed Mix: These mixes shall be cultipactor seeded only.

B Hydroseeding Preparation: Do all slurry preparation at the job site.

1 Do not dry mix seed or agitation will damage the seed.

2 Blend the water, Lawn Seed mixtures or meadow grass mixtures, hydroseeding soil stabilizer and hydroseed mulch into the hydroseeding machine according to the machine's mix schedule and component manufacturer's directions.

2 Commence spraying immediately when the tank is full.

C Hydroseeding Spraying Application:

1 General: Apply specified slurry mix in a sweeping motion to form a uniform mat at the specified rate. Keep hydroseeding within designated areas and keep from contact with other plant materials.

2 Unused Mix: Do not use any slurry mixture that has not been applied within four (4) hours of mixing. Promptly remove from the site.

3 Protection: After application, do not operate any equipment over the hydroseeded areas.

4 Reseeding: Reseed all areas and parts of areas that fail to show a uniform stand until all areas comply with the specified Warranty.

D Watering for Hydroseeded Lawns and Cultipactor seeded Grass Mixes

1 Watering shall be done again within 72 hours of installations or earlier if conditions require.

a Watering shall be done with a fine spray until the seed bed is moistened to a depth of (1/2) inches. Do not use a jet nozzle or permit disturbance of the seed bed or flood adjacent areas.

2 Rejected Materials: Remove rejected materials immediately from the site at Contractor's expense. Pay cost of testing of materials not meeting Specifications.

3.04 ATHLETIC FIELD LAWN (Cultipactor Seeding Only)

A Fine grade areas to be seeded as shown on the Drawings.

B Immediately before any seed is sown, the ground shall be scarified, or raked lightly until the surface is smooth, friable and of uniform fine texture.

C Sow the seed evenly by use of a cultipactor or approved seeding device. If a cultipacker is not used, cover seed with a layer of topsoil by dragging, light raking or other approved method. No seeding shall be done when the ground is frozen, excessively wet or otherwise nontillable. Do not broadcast seed when wind velocity exceeds 15 mph.

D Distribute seeds uniformly over designated areas at the specified rate. Sow half the seed with the sower moving in one direction and the remainder with the sower moving at right angles to the first sowing.

E Roll in two directions with a water ballast hand roller and water with a fine spray. Take extreme care during seeding and raking to ensure that no change occurs in the finished grades and that seed is not raked from one spot to another.

3.05 PROTECTIVE COVERINGS

1 Install jute mesh as specified in Section 02270 – Erosion Control on slopes 3:1 or greater.

3.06 MAINTENANCE AND PROTECTION OF LAWNS AND ALL GRASS SEED MIXES UNTIL ACCEPTANCE OF THE PRELIMINARY REVIEW

A See Section 31 0125 - Landscape Maintenance.

1 The Maintenance shall be as specified in PART-3 EXECUTION of Section 31 0125 for Lawns.

a This Maintenance shall begin immediately after the material is installed.

3.07 FIELD QUALITY CONTROL

A Tests: Samples of materials may be taken and tested for conformity to Specifications at any time.

3.08 CLEANING

A Erosion: Immediately restore eroded areas. Keep all adjacent paved surfaces cleaned of dirt, mud or stains and organic debris.

B Over - Sprayed Hydroseed Mix: Immediately clean over - sprayed hydroseed mix from any surface other than lawn.

END OF SECTION

SECTION 329400

BIORETENTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 RELATED WORK

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

1. Install all materials specified for the bioretention areas.

B. Related Work: The following items are noted and included in this Section and will be performed under the designated sections:

1. Section 329000 – PLANTING
2. Section 329200 – LAWNS
3. Section 334000 – STORM DRAINAGE UTILITIES

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Testing data for bioretention area soil materials as noted within this specifications and as per testing required within Section 329000-PLANTING and Section 329200 – LAWNS.
2. Testing data for bioretention area materials specified within this section follow the procedure noted.
3. Bioretention Planting Soil infiltration test results.

PART 2 - PRODUCTS

2.1 BIORETENTION MATERIALS

A. The following specifications set forth the required characteristics for materials used in bioretention facilities.

2.2 BIORETENTION SOIL

A. The Bioretention Planting Soil shall be a mixture of sand, compost, and topsoil to the following proportions by volume: 40% Sand, 20-30% topsoil, and 30-40% compost. Compost, sand, and topsoil materials shall be as specified herein.

1. Topsoil: The USDA textural classification of the Topsoil for the Bioretention Planting Soil shall be LOAMY SAND or SANDY LOAM. The Topsoil shall be fertile, friable soil, uncontaminated by salt water, foreign matter, or substances harmful to plant growth. There should be no course fragments over 1-inch in size. The soil shall have at least 4 percent organic matter but not more than 8 percent on a dry weight basis, soil moisture content less than 8% by weight for installation, and a pH range between 5.5 to 6.5. The Topsoil shall be tested and meet the following criteria:

Sieve Size	Percent Passing by Weight
No. 10	85-100
No. 40	35-85
No. 200	10-35
<20µm	< 5

2. The sand component of the Bioretention Soil shall be coarse sand that meets ASTM C-33 (Fine Aggregate) with a Fines Modulus Index of 2.75 or greater and shall conform to the following gradation:

Sieve Size	Percent Passing by Weight
3/8-inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

3. The leaf compost shall be a homogeneous and friable mixture of partially decomposed organic matter, with or without soil, resulting from the composting of yard waste in accordance with MassDEP Guidelines. The compost shall not contain biosolids. The compost shall contain less than 1% by dry weight debris including metal, glass, plastic, rubber, asphalt, concrete or masonry. The Carbon to Nitrogen Ratio shall be less than 30 to 1 and the pH shall be between 6.0 and 8.0.

4. The infiltration rate of the Bioretention Planting Soil Layer within the bioretention areas after installation shall be between 4 in/hr and 10 in/hr.

5. The Bioretention Planting Soil shall be a uniform mix, free of plant residue, stones, stumps, roots or other similar objects larger than two inches. No other materials or substances shall be mixed or dumped within the bioretention area that may be harmful to plant growth, or prove a hindrance to the planting or maintenance operations. The Bioretention Planting Soil shall be tested and meet the following criteria:

ITEM	CRITERIA	TEST METHOD
Corrected pH	5.5-6.5	AASHTO D4972
Magnesium	Minimum 32 ppm	*
Phosphorus (Phosphate-P_2O_5)	Not to exceed 69 ppm	*
Potassium (K_2O)	Minimum 78 ppm	*
Soluble Salts	Not to exceed 500 ppm	*

*Use authorized soil test procedures.

a. Should the pH fall outside of the acceptable range, the Bioretention Planting Soil may be modified with lime (to raise) or iron sulfate plus sulfur (to lower). The lime or iron sulfate must be mixed uniformly into the Bioretention Planting Soil prior to use in bioretention facilities.
b. Should the Bioretention Planting Soil not meet the minimum requirement for magnesium, it may be modified with magnesium sulfate. Likewise, should the Bioretention Planting Soil not meet the minimum requirement for potassium, it may be modified with potash. Magnesium sulfate and potash must be mixed uniformly into the Bioretention Planting Soil prior to use in bioretention facilities.
c. Planting soil and/or Bioretention Planting Soil that fails to meet the minimum requirements shall be replaced at no additional cost to Owner. Mixing of the corrective additives to the Bioretention Planting Soil is incidental and shall be at no additional cost to the Owner.
d. Mixing of the Bioretention Planting Soil to a homogeneous consistency shall be done to the satisfaction of the Designer. Upon approval of all requirements and testing above, the Bioretention Planting Soil shall be stockpiled, and no material shall be added to the Bioretention Planting Soil in the stockpile or during transport to the bioretention facility. If the Bioretention Planting Soil stockpiles are not placed in the Bioretention Basins within 30 days from the time of the testing, then the stockpile shall be retested. If the Bioretention Planting Soil no longer meets the requirements indicated above, then the Contractor shall provide the necessary additives to bring the soil back into compliance.

2.3 COARSE SAND

A. The infiltration rate of the Sand Filter layer within the bioretention areas after installation shall be 8 in/hr or greater.

B. The sand filter layer shall consist of clean inert, hard, durable grains of quartz or other hard durable rock, free from clay, organics, surface coatings or other deleterious material. Sand shall meet ASTM C-33 (Fine Aggregate), with a Fines Modulus Index of 2.75 or greater and shall conform to the following gradation:

Sieve Size	Percent Passing by Weight
3/8-inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

2.4 PEA GRAVEL

A. Pea gravel shall be placed over the underdrain crushed stone. Pea gravel shall consist of durable crushed rock or durable crushed gravel stone free from ice and snow, sand, clay, loam, or other deleterious or organic material. The peas gravel shall be double washed and shall be ¼ to 3/8 inch in size or equivalent to #9 double washed crushed stone.

2.5 CRUSHED STONE

A. The crushed stone to be placed around the underdrain piping shall be clean double-washed crushed aggregate, free of rock dust, fines or soil particles. Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following requirements:

Sieve Size	Percent Passing by Weight
1-inch	100
¾-inch	90-100
½-inch	10-50
3/8-inch	0-20
No. 4	0-5

2.6 UNDERDRAIN PIPING

A. Underdrain piping shall be used in the drainage stone layer of the bioretention facilities as indicated on the plans.

B. Clean out pipes must be provided where indicated on the plans.

C. Underdrain piping shall conform to the following specifications:

PIPE	STANDARD	PERFORATIONS
4" Corrugated Polyethylene Pipe	AASHTO M252, Type S	0.875" X 0.125" slots located in the outside valleys of the corrugations
4" Schedule 40 PVC	ASTM D-2665	5/8" holes @ 5" on center, located at the 4- and 8-o'clock position of the installed pipe

2.7 DRAINAGE FABRIC GEOTEXTILE FOR TEMPORARY SOIL PROTECTION

A. Filter fabric shall be used to temporarily cover the installed bioretention material layers to prevent siltation from other construction until the next material layer is placed. The fabric is to be removed prior to the placement of the next material.

B. Drainage filter fabric shall meet the following Minimum Average Roll Value (MARV) specifications across the weave:

PROPERTY	TEST METHOD	REQUIREMENT	PROPERTY	TEST METHOD	REQUIREMENT
Grab Tensile Strength	ASTM D-4632	80 lb. min.	Puncture Strength	ASTM D-4833	45 lb. min.
Grab Tensile Elongation	ASTM D-4632	50% max.	UV Resistance	ASTM D-4335	70% at 500 hrs min.
Trapezoidal Tear Strength	ASTM D-4533	35 lb. min.	Apparent opening	ASTM-D-4751	40-80 US Sieve
Mullen Burst Strength	ASTM D-3786	160 psi. min.	Permeability	ASTM D-4491	110 gal/min/ft.2 min.

2.8 IMPERMEABLE GEOMEMBRANE LINER

A. If basin excavation exposes subgrade determined by the Engineer or Soil Scientist to be at risk of instability due to hydrostatic subsurface water pressures from full bioretention basin, an impermeable geomembrane layer shall be required.

B. Geomembrane liner shall be a minimum of a 40-mil linear low-density polyethylene or thicker material, such as RUFCO 4000B or an approved equal, conforming to ASTM D 1593.

PART 3 - EXECUTION

3.1 COORDINATION

A. *Pre-Installation Examination Required:* The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify the Owner in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means the Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by the Owner.

B. The Engineer or Soil Scientist shall review the subgrade for conditions that warrant the installation of the impervious membrane.

C. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.

D. Excavate and install underdrainage system during construction of the Planting Soil underdrainage to facilitate ease of subsurface connections. Protect gravel and underdrainage perforated piping from construction sediment by temporarily covering gravel/piping with filter fabric.

E. Schedule and coordinate bioretention basin soil installation with placement of Planting Soils in adjacent areas.

F. Restrict all additional traffic other than installation from retention areas prior, during, and after installation.

3.2 EXCAVATION AND COMPACTION

A. Compaction of the bioretention areas shall be avoided prior to construction. Place barricades to restrict access to the areas.

B. Do not work the soil when it is too moist or frozen. If the soil smears when worked, it is too moist. Refer to Section 329000-Planting and Section 329200 – Turf and Grasses.

C. The subgrade shall be nearly level with a gradient less than ½ (0.5) percent.

D. Subsoil compaction at the base of the bioretention facility shall be alleviated using primary tilling equipment such as a chisel plow, ripper, or subsoiler. Tilling operations shall be used to refracture the sub-grade to a depth of 12 inches.

3.3 BIORETENTION CONSTRUCTION

A. Crushed Stone Installation: After excavation of the basin bed is complete and preparation of the subgrade meets specifications, install at least 4 inches of the specified crushed stone gravel in the bottom of the retention basin prior to pipe placement.

B. Perforated Pipe Installation:

1. The main collector pipe for underdrain systems shall be constructed with a slope between 0.25 to 1.0%. All piping shall be of uniform gradient and provide unrestricted flow to the outlet.
2. Perforated pipe shall be placed with the perforations down at 4 and 8 o’clock positions (PVC pipe).
3. The ends of underdrain pipes without a cleanout shall be capped.

4. Place the remaining specified crushed stone to a depth of 12 inches.
5. Temporarily cover the crushed stone surface with fabric to prevent sedimentation of the gravel layer prior to the placement of the pea gravel layer. The fabric is to be removed prior to pea gravel layer placement.

C. Pea Gravel Installation: Place the pea gravel to a depth of 4 inches.

D. Sand and Bioretention Planting Soil Installation: Never work bioretention planting soil when wet or frozen. See Section 329000-Planting and Section 329200 – Turf and Grasses for coordination procedures.

1. The Bioretention Planting Soil media shall be homogenous. Soils that have visible lumps of material or coarse fragments (rocks) greater than 2.5 cm (1-inch) is cause for rejection.
2. The sand and bioretention planting soil shall be placed in 6-inch lifts. Installation traffic is allowed to spread and “seat” the soil, but additional soil compaction is strictly forbidden. Do not use heavy equipment within the bioretention facility.
3. Scarify the surface of each lift to prevent compaction interfaces that will reduce the functionality of the retention basin.
4. Test infiltration rates of completed Sand Filter layer and submit results to the engineer. Determine permeability of the layer using a single ring infiltrometer method after it has been scarified. Gain approval of Sand Filter layer installation infiltration prior to placement of the Bioretention Planting Soil layer. At the completion of the Bioretention Planting Soil layer prior to plant and seed placement, test the infiltration rate and submit to the engineer.
5. Heavy equipment can deliver bioretention materials to the basin from outside of the bioretention area.
6. Grade bioretention materials with light equipment such as a tracked skid-steer or a dozer/loader with marsh tracks.
7. Back blading of the soil with buckets or doze blades is strictly forbidden.
8. The bioretention planting soil media shall be saturated with water to settle the media before the final lift so that it can be adjusted in the field to correspond to the plan elevations. The water to saturate the placed bioretention planting soil shall either be provided by the Contractor or from a rain event capable of saturating the soil.
9. No other materials or substances shall be mixed or dumped within the bioretention area that may be harmful to plan growth, or prove a hindrance to the planting or maintenance operations.

3.4 PROTECTION AND REPAIRS

A. During bioretention area construction, protect partially finished soil installation with weighted plastic tarps during heavy precipitation events until protective vegetation has been placed and established.

B. Place soil erosion structures such as filter fence, straw bales, and erosion netting on the surfaces of bare soil surrounding the bioretention basins until vegetation is established.

C. If blowing of material is a concern, a biodegradable netting can be spread over the surface until the facility has gone through several wetting cycles.

D. Bioretetion Area Protections shall be maintained until the surrounding surface areas throughout the entire vegetation establishment period and as approved by the Engineer.

E. Vegetate the surrounding catchment areas as quickly as possible.

F. Protect newly graded areas from traffic, freezing and erosion. Keep free of trash, debris or construction materials.

G. Repair, re-shape and re-establish finished grades where areas settle, erode, are disturbed or damaged.

H. Refer to Section 329000-Planting and Section 329200 – Turf and Grasses for coordination of protection measures between retention construction and planting soil installation.

3.5 INSPECTION AND MAINTENANCE

A. After construction, monthly inspection of the bioretention facilities shall be conducted until the plants are established.

B. The Contractor shall provide water to establish the seeding and/or plantings within the bioretention area.

C. Remove all visible accumulations of sediment on top of the vegetated surface with a flat shovel. Stabilize eroded areas with appropriate geotextile and replant as required to establish growth.

END OF SECTION

SECTION 33 10 00
WATER UTILITIES

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of Specifications.

1.2 DESCRIPTION OF WORK

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

1. Installation of ductile iron pipe, fittings, accessories, and appurtenant work, at the locations and to the lines and grades indicated on the Contract Drawings.
2. The installation of hydrants, gate valves and boxes and concrete thrust blocks.
3. Furnishing and installation of all materials required to connect to existing water mains, replace existing services, new gate valves, tapping sleeves, removal of existing gate valves, corporation cocks, saddles, curb stops, service boxes, and abandoning of the existing water system (if applicable), all as shown on the Contract Drawings. All valves, twelve (12) inches and larger shall be butterfly valves. All abandoned pipes shall be plugged and capped with concrete.
4. In accordance with 528 CMR 12.00, work on the fire protection system, including hydrants and exterior underground piping, shall be performed by a Licensed Fire Protection Sprinkler Systems Contractor. The fire protection exterior underground piping will terminate at the valved tee connection to the water distribution system. The tee and valve will not be considered part of the fire protection system work.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections.

1. Section 31 20 00 – EARTH MOVING for excavation, backfill, and compaction requirements.

2. Section 21 11 00 – FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

1.3 SUBMITTALS

A. Refer to Section 01 33 00 – SUBMITTAL PROCEDURES for submittal provisions and procedures.

1. Descriptive literature showing pipe dimensions, pipe and joint materials and dimensions, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.
2. Product Data: Submit manufacturer's technical product data and installation instructions for potable water system materials and products.
3. Shop Drawings: The Contractor shall submit for review shop drawings or descriptive literature for potable water system, showing piping, fittings, couplings, valve, hydrants, materials, dimensions, restrained joint calculations, joints and other details, blocks, and anchors. All hydrants and valves furnished under the Contract shall be manufactured

only in accordance with the Specifications and the approved Shop Drawings.

4. Record Drawings: At project closeout, submit record drawings of installed potable water system piping and products, in accordance with requirements of Division 1. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built Drawings shall include a minimum of three (3) ties to each valve cover from fixed permanent objects. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor and Licensed Professional Engineer. The as-built plans shall also be submitted electronically as an AutoCAD drawing file (release 2002 or higher).
5. Maintenance Data: Submit maintenance data and parts lists for water system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 1.

1.4 REFERENCE STANDARDS

A. The following standards are applicable to the work of this Section to the extent referenced herein:

1. ASTM: American Society for Testing and Materials.
2. ANSI: American National Standards Institute.
3. AWWA: American Water Works Association.
4. AASHTO: American Association of State Highway and Transportation Officials.
5. Commonwealth of Massachusetts, Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges, latest English Edition with amendments, hereinafter referred to as the “Standard Specifications.” All references to method of measurement, basis of payment and payment items in the Standard Specifications are hereby deleted. References made to particular sections or paragraphs in the Standard Specifications shall include all related articles mentioned therein.
6. Commonwealth of Massachusetts, Massachusetts Highway Department, Construction Standards, latest Edition with amendments, hereinafter referred to as the “Construction Standards.”
7. Commonwealth of Massachusetts State Plumbing Code, latest edition.
8. Commonwealth of Massachusetts Regulations 528 CMR 12.00 Sprinkler Contractor Licensing Regulations.
9. Town/City Water Department Regulations

1.5 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of portable water systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications: Firm with at least three years of successful installation experience on projects with portable water piping work similar to that required for this project.

C. Water Purveyor Compliance: Comply with requirements of Purveyor supplying water to project, obtain required permits and inspections.

D. A Certificate of Substantial Completion shall be issued upon acceptance of this work.

PART 2 – PRODUCTS

3.1 DUCTILE IRON PIPE AND FITTINGS

A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Engineer to comply with installation requirement. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.

1. Ductile iron pipe shall be that of a manufacturer who can demonstrate at least five years of successful experience in manufacturing ductile iron pipe. The pipe shall be equipped with push-on type, restrained joint, or mechanical joints, as required.
2. All ductile iron water pipe shall conform to American Water Works Association (AWWA) C150 and AWWA C151.
3. The ductile iron pipe shall be Class 52 and furnished in minimum nominal 18-foot lengths, with Push-on or Mechanical Joints as manufactured by U.S. Pipe and Foundry Company, Atlantic States Cast Iron Pipe Co., Clow Corporation, or approved equal with gaskets conforming to AWWA C111 "Rubber Gasket Joints". A minimum of two brass wedges per joint shall be used to maintain conductivity and facilitate lock-on.
4. All ductile iron pipes shall be rated for a minimum operating pressure of 350 psi.
5. The ductile iron water pipe shall be double cement lined inside and then asphalt seal coated in accordance with AWWA C104 and AWWA 203. The pipe shall be furnished along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.
6. All water pipe shall be encased in polyethylene film when the trench is backfilled with control density fill.
7. Fittings shall be short body ductile iron Class 350 Mechanical Joint, conforming to ANSI Specification AWWA C153, latest edition, for pipe sizes 16-inches and smaller, and Class 350 standard Mechanical Joint fittings conforming to AWWA C110, latest edition, for pipe sizes 16 through 24-inches, unless specifically stated otherwise in the Specifications or on the Contract Drawings. Fittings shall have the same lining and coating as the pipe specified above. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends. Fittings greater than 24-inches shall be as specified above except they shall be Class 250. All nuts and bolts shall be of a type equal to ductile iron or KOR-10 steel T-bolts and nuts or an approved equal.
8. In order to provide positive joint restraint, valve anchor tees/valves and restrained joints shall be used on fires services and the on 6-inch branch connections for hydrants.
9. Caps and plugs installed in all new work as indicated on the Contract Drawings shall be provided with a threaded corporation or bleeder valve so that air and water pressure can be relieved prior to future connection.
10. Contractor shall provide all adapters and fittings such as transition couplings, as determined in the field, necessary to complete all cross-connections, whether or not specifically stated in the Contract Drawings and Specifications.
11. All pipe shall be marked with the class, thickness designation and initials of the manufacturer.
12. If required the manufacturer shall supply the Engineer with certificates of compliance with these Specifications and certification that each piece of ductile iron pipe has been tested at the foundry with the Ball Impression Test, Ring Bending, or equal.
13. Thrust blocks shall be used at all bends and fittings as shown on the details. In addition, all bends and fittings shall be restrained with Megalug Series 1100 mechanical joint restrained. In the event that the use of thrust blocks is not practical, the Contractor shall

provide an alternate method of joint restraint, at no additional cost to the owner, as approved and/or as directed by the Engineer. Restraint length calculations and restrained joint locations shall be provided by the contractor and submitted to the engineer for review. Restraint length values shall be calculated per the manufacture's standards.

a. Restraint for standardized mechanical joints shall be incorporated in the design of the follower gland and shall impart multiple wedging action against the pipe, increasing its resistance as the pressure increases. The assembled joint shall maintain its flexibility after burial and shall maintain its integrity by a controlled and limited expansion of each joint during the wedging action. Restraining glands shall be manufactured of high strength ductile iron conforming to the requirements of ASTM A536, Grade 65-45-12. Wedging mechanisms shall be manufactured of ductile iron, heat treated to a hardness of 370 BHN minimum. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee head bolts conforming to the requirements of ANSI/AWWA A21.11/C111 and ANSI/AWWA A21.53/C153 of latest revision. Twist-off nuts shall be incorporated in the design of the wedge activation screws to insure proper torque. The mechanical joint restraining device shall have a water working pressure rating of 350 psi minimum (in sizes 4" thru 16") with a safety factor of at least 2:1 against separation when tested in a dead-end situation.
b. Restraint for push-on ductile iron pipe shall consist of a wedge action restraint ring on the spigot joined to a split ductile iron ring behind the bell. The restraint ring shall have individually actuated wedges that increase their resistance to pull-out as pressure or external forces increase. The restraint ring and its wedging components shall be made of minimum grade 65-45-12 ductile iron conforming to ASTM A536. The wedges shall be heat treated to a minimum hardness of 370 BHN. Torque limiting twist off nuts shall be used to insure proper actuation of the restraining wedges. The split ring shall be made of a minimum grade of 65-45-12 ductile iron conforming to ASTM A536. The connecting tie rods that join the two rings shall be made of low alloy steel that conforms to ANSI/AWWA C111/A21.11. The assembly shall have a rated pressure with a minimum two to one safety factor of 350 PSI in the sixteen inch size and below 250 PSI in the eighteen through thirty-six inch sizes. Push on joints on ductile iron pipe shall be restrained with Megalug Series 1700 restraint harness.

14. Insulation shall be manufactured by Thermal Pipe Systems, Atlas Insulation, or Insulated Piping Systems Inc., or other approved manufacturer. Insulation shall be factory foamed-in-place polyurethane foam insulation having nominal thickness of 1 1/2-inch, with an in-place density of 2.5 pcf, and a "K" factor of 0.14 BTU/in./hr./°F/sq. ft. Straight joints between insulated pipe lengths, and the end sections of non-insulated pipe, shall be sealed with heat shrinkable wrap-around polyethylene as supplied by manufacturer and installed in field by Contractor. Insulation jacket shall be 20 gauge corrugated aluminum preformed to be fastened with stainless steel screws and bands. Jacket shall have one layer of one mil polyethylene film with a protective coat of 40 pound virgin Kraft paper to act as a moisture and galvanic corrosion barrier.
15. Pipe for use with split couplings shall be as specified except that the ends shall not have bells or beads but shall have cast or machined shoulders or grooves as necessary for the couplings to be used and shall conform to the specifications of the manufacturer of the couplings. If split couplings are used with grooved ductile-iron pipe, the minimum pipe wall thickness shall be as follows:

Nominal Pipe Size (In.) Thickness Class

14-18	54
20	55
24	56

16. Pipe for use with sleeve-type couplings shall be as specified except that the ends shall be plain (without bells or beads). The ends shall be cast or machined at right angles to the axis.

B. COUPLINGS AND ADAPTERS FOR DUCTILE IRON PIPE

1. Sleeve-type couplings for plain-end pipe shall be provided with plain rubber gaskets and steel, tee-head bolts with nuts. Couplings shall be Dresser style 38 or 138, furnished preassembled, as manufactured by Dresser Industries, Inc., Smith-Blair, Coupling Systems, Inc., or equal.
2. Couplings or adapters as required for connecting existing pipe to new pipe or new pipe to new pipe shall be furnished as required and designed for compatibility with the pipe and operating pressures encountered. Couplings shall be Dresser Style 162 as manufactured by Dresser Industries Inc., or equal. Flanged adapters shall be Dresser Style 128, or equal. Couplings for ductile iron to cast iron pipe shall be Style 53, and for ductile iron to transite pipe shall be style 153, as manufactured by Dresser Industries, Inc., or as manufactured by Smith-Blair, Coupling Systems, Inc. or equal. Transition couplings shall be style 162 as manufactured by Dresser Industries, Inc. or approved equal.
3. Split couplings may be used for connecting gray cast iron or ductile iron. If split couplings are used with grooved ductile iron pipe, the minimum pipe wall thickness shall be as specified. Split couplings shall be made of malleable iron and shall be suitable for use with grooved-end or shouldered-end, cast iron pipe. They shall be Victaulic couplings made by the Victaulic Company of America, Elizabeth, New Jersey; Gruvagrip couplings made by Gustin-Bacon Manufacturing Company, Kansas City, Missouri; Groove couplings made by Eastern Malleable Iron Company, Pittsburgh, Pennsylvania; or equal products.
4. Flexible Couplings: Sleeve-type couplings for plain-end ductile iron pipe shall be provided with plain rubber gaskets and steel, track-head bolts with nuts.
5. Couplings shall be furnished pre-assembled by the manufacturer.
6. Couplings shall be given a shop coat compatible with the same outside coating as the pipe specified above.
7. All couplings shall be furnished with the pipe stop removed.
8. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe. The gaskets shall have metallic tips to provide electrical continuity through the joint.
9. The Contractor shall provide suitable filling rings where the layout of the flanged piping is such as to necessitate their use. In materials, workmanship, facing, and drilling, such rings shall conform to the 125 pound ANSI Standard. Filling rings shall be of suitable length with nonparallel faces and corresponding drilling, if necessary, to endure correct assembly of the adjoining piping or equipment.
10. Couplings for exposed pipe shall be of steel and shall be Dresser Style 38, Smith-Blair Style 411, Baker Allsteel, or equal. The couplings shall be provided with steel bolts and nuts.
11. At the Contractor's option, flexible connections in the piping shall be sleeve-type couplings, split couplings or mechanical joint pipe as herein specified.

C. INSPECTION, TESTS AND ACCEPTANCE FOR DUCTILE IRON PIPE

1. All pipe delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to "AWWA Standard for Ductile Iron Pipe, for Water and Other Liquids" (AWWA H3) and (AWWA C151).
2. All tests shall be made in accordance with the methods prescribed by the above mentioned AWWA Standards, and the acceptance or rejection shall be based on the test results.
3. Pipe which does not conform to the requirements of this contract shall be immediately removed and replaced by the Contractor.
4. All ductile iron pipe to be installed under this Contract may be inspected at the foundry for compliance with these Specifications by an independent testing laboratory selected by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of foundry inspection of all pipe approved for this Contract, plus the cost of the inspection of a reasonable amount of disapproved pipe, will be borne by the Owner.

D. FLANGED JOINTS FOR DUCTILE IRON PIPE

1. For flanged joints, gaskets shall be ring gaskets of rubber with cloth insertion. Gaskets twelve (12)-inches in diameter and smaller shall be 1/16-inch thick, gaskets larger than twelve (12)-inch shall be 3/32-inch thick.
2. Flanged joints shall be made with bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges. Bolts and nuts shall, except as otherwise specified or noted on the Contract Drawings, be Grade B conforming to the ASTM Standard Specification for Carbon Steel, Externally and Internally Threaded Standard Fasteners, Designation A307. Bolts and studs shall be of the same quality as machine bolts. Flanged ductile iron pipe from 3 to 48-inches in diameter shall be classified by Underwriters Laboratories Inc. in accordance with AWWA C115.

3.2 TAPPING SLEEVES AND VALVES

A. Tapping sleeves shall be of ductile iron construction, meeting ASTM A536 Grade 65-45-12. Side flange seals shall be O-Ring type of round, oval or rectangular cross-section shape. Sizes 12” and smaller must be capable of working on Class ABCD pipe diameters without changing either half of sleeve. Sizes 14” and larger must be specified to which class is needed. All sleeves are to include the end joint accessories and split glands necessary to assemble sleeve to pipe. Sleeve shall be coated with asphaltic varnish in compliance with NSF-61.

B. Tapping valves shall conform to the requirements specified above for gate valves except that all Tapping sleeves and valves shall consist of a ductile iron flanged by mechanical joint sleeves and a tapping-type gate valve with one flange and one mechanical joint end. The Contractor shall be responsible for verifying the outside diameter of the pipe to be tapped.

C. The valve shall be provided with an oversized seat to permit the use of full size cutters. Before backfilling, all exposed portions of any bolts used to hold the two halves of the sleeves together shall be heavily coated with two coats of bituminous paint comparable to Inertol No. 66 Special Heavy. Sleeves shall be of ductile iron furnished with O-ring gaskets.

D. Bolts on bonnet and stuffing box shall be stainless steel (316 stainless steel), stuffing boxes shall be “O” ring type as indicated. Gaskets shall cover the entire flange surface.

3.3 POST INDICATOR VALVE

A. Post indicating valve assembly shall consist of a buried butterfly valve and above-grade indicator actuator of the traveling nut type with a tamper-proof switch.

B. Posts shall have two large window openings that shall be fitted with a heavy clear Plexiglas. Aluminum target plates, with large words OPEN and SHUT cast in large, easy-to-read, raised letters shall be located directly behind each window in such a position that the appropriate words appears as the valve is opened.

C. The target mechanism shall consist of an internal rotating member that contains a 2¾-inch hole on four sides.

D. The outer member is stationary and shall contain similar holes.

E. A fail-safe spring shall be included on the post to preclude accidental closing.

F. Stem, indicators, and all working parts shall be fully protected from moisture and weather damage.

G. The butterfly valve and post assembly shall be Underwriters Laboratory listed and Factory Mutual approved.

H. Valves shall be manufactured in accordance with AWWA C504, Class 150B.

3.4 HYDRANTS

A. General: Provide Hydrants as indicated. The Hydrants shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the hydrant.

1. Fire hydrants shall meet or exceed AWWA C-502, latest revision and shall comply with Factory Mutual Research Corporation and Underwriters' Laboratories UL 246 Standard. Rated water working pressure shall be 200 psi, test pressure shall be 400 psi.
2. The main valve closure shall be of the compression type, opening against the pressure and closing with the pressure.
3. Hydrants shall be of the breakaway type: The upper barrel shall connect to the lower barrel with a breakable traffic flange and 8 bolts and nuts. This connection shall allow 360 degree rotation of the upper nozzle section.
4. The main valve opening shall be 5-1/4 inch and be designed so that removal of seat, drain valve mechanism, internal rod and all working parts can be removed through top of hydrant. These parts shall be removable without disturbing the ground line joint or the nozzle section of the hydrant. The bronze seat shall be threaded into mating threads of bronze for easy field removal.
5. The draining system of the hydrant shall be bronze and activated by the main stem without use of auxiliary rod, toggles, pins, etc. The drain mechanism shall be completely closed after no more than three turns of the operating nut in the opening direction. There should be a minimum of (2) inside ports and (4) drain port outlets to the exterior of the hydrant. Drain shut off to be by direct compression closure.
6. The operating nut, main stem, coupling and main valve assembly shall be capable of withstanding input torque of 200 ft. lbs in opening or closing directions. There shall be an internal top housing with triple O-Rings to seal operating threads from the waterway and accommodate an anti-friction washer.
7. Fire hydrants shall have 6-inch mechanical joint inlet connections to the main, two 2 1/2-inch hose connections, 180-degrees apart, and one 4 1/2-inch steamer connection. The hose and steamer connections shall have National Standard Thread. The standpipe shall have an 8 1/2-inch minimum diameter. All nozzle caps shall be cast iron and shall be secured to the hydrant barrel with chains.

8. Hydrant shall be marked with an arrow and the word "open" to indicate the direction to turn the stem to open the hydrant. Hydrants shall open to the direction specified by the Town of Lincoln and have a bronze operating nut that shall be pentagonal in shape, 1-1/2 inch from point to opposite flat.
9. The upper barrel shall be ductile iron with markings identifying size, model and year of manufacture. The lower barrel shall be ductile iron.
10. The hydrant shall have a minimum working pressure of 200 psi. Hydrant design shall be of positive automatic drain type to prevent freezing.
11. Hydrants shall be thoroughly cleaned and given two (2) shop or field coats of paint in accordance with AWWA C502 and the instruction of the paint manufacturer. Paint color shall be the standard hydrant color of the Town of Lincoln
12. If the hydrant is delivered with the manufacturer's standard color, the hydrant shall be given one (1) matching field coat of alkyd gloss enamel. If the hydrant is delivered with no standard color, the hydrant shall be given two (2) coats of alkyd gloss enamel according to the colors specified by the Town of Lincoln.
13. All expose metal surfaces will be painted.
14. Hydrant paint shall be as manufactured by Sherman-Williams, PPG Industries, Pittsburgh, PA; Koppers Company, Inc., Pittsburgh, PA ; Tnemec Company, Inc. Kansas City, MO; or approved equal.
15. Alkyd gloss enamel shall be Series 54-300 by PPG; Glamortex by Koppers; 2H-Tneme by Tnemec or approved equal.
16. Hydrants shall be American Darling (American Flow Control) Model B-62 B, Mueller Centurion, Kennedy Guardian, U. S. Pipe Metropolitan, Waterous WB-67 or others as acceptable to the jurisdictional authority.

B. HYDRANT SAFETY FLANGE REPAIR KITS

1. Safety flange repair kits shall come complete with stem coupling, safety flange, flange gasket, replacement bolts and nuts and hydrant lubricating oil.
2. Safety flange repair kits shall be compatible with hydrant furnished.

C. HYDRANT EXTENSION KITS

1. Extension kits shall come complete with extension barrel, extension stem, stem coupling and hardware, flange, flange gasket, 8 bolts and nuts and hydrant lubricating oil.
2. Extension kits shall be compatible with hydrant furnished.

3.5 IDENTIFICATION

A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils minimum thickness, with continuously printed caption in black letters "CAUTION - xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer, Storm Sewer
White	Proposed Excavation

PART 3 – EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which potable water system's materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Engineer.

B. The Contractor is responsible for the provisions and all test requirements specified in herein. In addition, all pipe and appurtenances may be inspected at the plant for compliance with these specifications by an independent testing laboratory.

C. All tests shall be made in accordance with the methods prescribed by the above-mentioned AWWA Standards, and the acceptance or rejection shall be based on the test results.

D. Inspection of the pipe and appurtenances may also be made after delivery. The pipe and appurtenances shall be subject to rejections at any time on account of failure to meet any of the specifications requirements, even though samples may have been accepted as satisfactory at the place of manufacture.

E. Pipe which does not conform to the requirements of this contract shall be immediately removed and replaced by the Contractor at no cost to the Owner.

3.2 HANDLING PIPE

A. The Contractor shall take care not to damage pipe by impact, bending, compression, or abrasion during handling, and installation. Joint ends of pipe especially shall be kept clean.

B. Pipe shall be stored above ground at a height no greater than 5-feet, and with even support for the pipe barrel.

C. Only nylon-protected slings shall be used for handling the pipe. No hooks, chains or bare cables will be permitted.

D. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors.

3.3 INSTALLATION OF PIPE AND PIPE FITTINGS

A. The Contractor shall provide all adapters and fittings such as transition couplings, as determined in the field, necessary to complete all cross-connections, whether or not specifically stated in the Contract Drawings and Specifications.

B. Care shall be taken in loading, transportation, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe and fittings shall be examined before placement, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Engineer or Owner’s Representative.

C. If any defective pipe is discovered after it has been placed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense. All pipe and fittings shall be kept clean until they are used in the work, be thoroughly cleaned before placement, and when placed, shall conform to the lines and grades required. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as

otherwise provided herein. A firm even bearing throughout the length of the pipe shall be constructed by compacting sand gravel borrow around the pipe and up to 18 inches above the pipe.

D. Blocking will not be permitted.

E. A minimum horizontal separation of ten (10) feet shall be maintained between and existing, proposed or relocated sewer and the new water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten foot separation, it is permitted to install a water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located eighteen (18) inches above the top of sewer. Where the horizontal clearance is less than ten (10) feet or the vertical clearance is less than eighteen (18) inches and the sewer crosses under the water main, both water main and sewer main shall be constructed of mechanical joint cement lined ductile iron pipe for a distance of 10-feet on either side of the crossing. One (1) full length of water pipe shall be centered over the sewer at the crossing. If the sewer crosses over the water main, regardless of the vertical separation, both pipes shall be concrete encased for a distance of ten (10) feet to either side of the respective centerline.

F. Provide minimum cover over piping of 5-feet below finished grade.

G. Extend water systems from the water main located within the public way and terminate portable water piping 10-feet 0-inches from the building foundation. Provide temporary pipe plug for piping extension into building if required by construction progress.

H. All pipes shall be sound and clean before placement. When pipe laying is not in progress, including lunchtime, the open ends of the pipe shall be temporarily closed by watertight plug or other acceptable means. Alignment shall be maintained during placement. The deflection at joints shall not exceed sixty percent of that recommended by the manufacturer. Fittings, in addition to those shown on the plans, shall be provided, if required, in crossing utilities, which may be encountered upon opening the trench. Solid sleeves shall be used only where allowed by the Engineer.

I. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on type bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be inspected for damage and shall be remortared as required to ensure a continuous lining.

J. Mechanical joint restraints shall be used for all valves, bends, hydrants and piping section less than 50 feet. The contractor shall restrain all pipe runs to the lengths indicated on the approved restrained joint calculation shop drawings.

K. Jointing of ductile iron push-on pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The last 8-inches of the outside of the spigot end of pipe and the inside of the bell end of pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be painted with a lubricant just prior to making up the joint. The spigot end shall then be gently pushed home into the bell. The position of the gasket shall be checked to insure that the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.

1. Jointing Ductile Iron Pipe (Push-On Type): Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined, and pushed home

with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.

2. Jointing Mechanical Joint Fittings: Mechanical joints at valves, fittings, and where designated shall be installed in accordance with the "Notes on Method of Installation" under ANSI Specification A 21.11 and the instructions of the manufacturer. To assemble the joints in the field, the Contractor shall thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torque. Under no condition shall extension wrenches or pipes over handles or ordinary ratchet wrenches be used to secure greater leverage.

L. Installation and jointing of ductile iron pipe shall be in accordance with AWWA C600, Sections 9b and 9c, latest revision, as applicable.

M. Ductile iron pipe installed within 5-feet of gas lines shall be fully encased with polyethylene material. Polyethylene shall be 8-millimeters thick and comply with AWWA C-105.

N. Service tubing shall be installed with minimum 6-inches of sand bedding and 12-inches sand cover. Service tubing shall have a minimum total cover of 5 feet.

3.4 INSTALLATION OF VALVES AND APPURTANCES

A. Cleaning And Prime Coating Valves And Appurtenances (Except Epoxy Coated Valves)

1. Prior to shop prime coating, all surfaces of the valves and appurtenances shall be thoroughly clean, dry, and free from all mill-scale, rust, grease, dirt, paint and other foreign substances to the satisfaction of the Engineer or Owner's Representative.
2. All ferrous surfaces shall be sand blasted or pickled according to SSPC-SP6 or SSPC-SP8, respectively.
3. All gears, bearing surfaces and other surfaces not to be painted shall be given a heavy coat of grease or other suitable rust resistant coating unless otherwise specified herein. This coating shall be maintained as required to prevent corrosion during any period of storage and installation and shall be satisfactory through the time of final acceptance.

B. INSTALLATION

1. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired before they are installed.
2. Care shall be taken to prevent damage to valves and appurtenances during handling and installation. All materials shall be carefully inspected for defects in workmanship and materials, all debris and foreign material cleaned out of valve openings, etc., and all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment that do not operate easily, or are otherwise defective, shall be repaired or replaced.

C. SHOP PAINTING VALVES AND APPURTENANCES

1. Interior and exterior surfaces of all valves which are not factory epoxy coated shall be given two coats of shop finish of an asphalt varnish conforming to AWWA C504 for Varnish Asphalt. The pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

D. BURIED VALVES

1. Install valves as indicated with stems pointing up. Provide valve box over underground valves. Buried valves and boxes shall be set with the operating stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping selected excavated material under and at the sides of the valve.

E. VALVE BOXES

1. Valve boxes shall be installed vertically, centered over the operating nut, and if they are in the limits of the roadway or within limits where the plowing of snow will take place in the winter, the tops of the boxes shall be set ½" below the top of the finished grade. In locations where these boxes are not likely to be disturbed, the tops shall be set flush with the adjoining ground. Boxes shall be adequately supported during backfilling to maintain vertical alignment.

3.5 INSTALLATION OF HYDRANTS

A. Hydrants and hydrant branches shall be tested at 175 psi and chlorinated as specified in this specification.

B. Hydrants shall be installed in conformance to AWWA C 600, Section 11, latest revision, using thrust blocks and restrained joints in accordance with the details shown on the Contract Drawings.

C. Hydrants as detailed on the Contract Drawings shall be set at the locations designated by the Engineer and shall be bedded on a firm foundation. A drainage pit 2-feet 6-inches in diameter and to the limits shown on the Contract Drawings shall be filled with crushed stone and satisfactorily compacted. During backfilling, additional crushed stone shall be brought up around, and 6-inch over the drain port. Each hydrant shall be set in true vertical alignment and shall be properly braced. Thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Hydrant shall be set upon a slab of concrete not less than 4-in thick and 15-in square.

D. Hydrants shall be set plumb with the steamer nozzle facing the roadway and the center of the operating nut located 18-inches back from the face of curb or edge of pavement.

E. Hydrants shall be set such that the bottom of the breakaway feature shall be a minimum of 2-inches and a maximum of 4-inches above finish grade.

F. Once installed, hydrants shall be painted once again by the Contractor. Hydrants shall be painted in accordance with the Owner's requirements.

G. All iron work to be set below ground, after being thoroughly cleaned, shall be painted with two coats of asphalt varnish as specified in AWWA C502, latest revision and iron work to be left above ground shall be shop painted with two coats of paint.

H. Thrust Blocks: Concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the Contract Drawings. Felt paper shall be placed as shown on the Contract Drawings. Care must be taken to ensure that concrete does not plug the drain ports.

3.6 BACKFILLING

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed, all in accordance with local requirements and the contract documents.

B. Initial backfill shall be placed evenly on both sides of the pipe to distribute the load and not to cause movement or deflection of the pipe.

3.7 FIELD QUALITY CONTROL

A. Testing of Water Main/Service:

1. Prior to pressure testing, the entire line shall be water jetted to remove any rocks or debris that may have inadvertently entered the pipe during construction.
2. The Contractor in accordance with AWWA C651-99 specifications or latest revision will make pressure and leakage tests thereof, to determine that the ductile iron pipe is structurally safe and free of excess leakage. Pipeline shall be subject to a hydrostatic test of 150 pounds per square inch (psi) or 150% of the static pressure, whichever is greater. The Contractor shall furnish all equipment, materials and labor for testing. Testing shall be done between valved off sections in approximately 1000-foot maximum section of the main. The Contractor shall furnish at his own expense the water needed for all water main testing.
3. Once the pipeline section has been filled at normal pressure and all entrapped air removed from the line, the Contractor shall raise the pressure to the approved test pressure by a special pressure pump taking water from a small tank of proper dimensions for satisfactorily measuring the rate of pumpage into the pipeline. The pipe shall maintain this pressure, within 5 psi, for a minimum of two hours during which time the line shall be checked for leaks. The measured water leakage shall not exceed the maximum allowed leakage as determined by the following equation for the section under test:

$$L = \frac{SDP^{1/2}}{133{,}200}$$

Where:
L = Allowable leakage, gallons per hour
S = Length of pipe section tested, feet (1,000-foot maximum)
D = Nominal pipe diameter, inches.
P=Average test pressure (psi)

Should leakage exceed this rate, the Contractor shall immediately locate the leak or leaks and repair same at his expense. Pipe shall be flushed and chlorinated when leakage does not exceed above standard. Approval does not absolve the Contractor from his responsibility if leaks develop within the new main or water services (to curb box) later within the period of warranty.

B. Testing of Fire protection service:

1. Testing of fire protection services shall conform to the most current NFPA requirements.

C. Chlorinating and Flushing:

1. Prior to chlorination, the Contractor shall properly flush mains. In general, flushing shall be performed at a flow rate required to achieve a minimum velocity of 2.5-feet per second (approximately 900 GPM in a 12-inch diameter main and 400 GPM in 8-inch diameter main). Flushing shall be performed for a sufficient period of time to allow for a minimum of 3 volume changes of water in the main (approximately 20 minutes per 1,000-foot of 8-inch main at the above flow rate).

2. Chlorinating shall be accomplished by pumping a chlorine solution into the mains. Water shall be allowed to enter the new water mains until the mains are full of a solution containing 25-ppm available chlorine. The valves shall then be closed and the chlorinated water allowed to stay in the mains for 24 hours. At the end of this period, the chlorine residual shall be at least 10 mg/l. If it is less than 10 mg/l measured, Contractor shall flush and rechlorinate the mains at no cost to the Owner. All valves and hydrants shall be operated to insure their proper disinfection and shall be manipulated to prevent superchlorinated water from entering the existing distribution system. After this period, the Contractor shall flush the mains until clear, clean water is being discharged.
3. Chlorinating and flushing shall be done in accordance with AWWA C651-99 Specifications.
4. Twenty-four hours after the main has been flushed of chlorinated water, bacteriological samples shall be taken. Water samples shall be taken from corporation stops along the length of the water main as designated by the Engineer. A minimum of two (2) samples shall be taken, per 3,000 foot of pipe or on each street, whichever is greater, each in duplicate, in sterile bottles and sent to a State approved private laboratory for analyses. The Contractor shall perform all necessary work including delivery of samples to a certified laboratory, and shall include the cost for sampling and analysis in his bid price. The results of the tests on these samples will determine the acceptance of the work and allow these new mains to be connected to the District's system. The failure of any sample to pass the laboratory tests shall require the Contractor to reflush and rechlorinate the mains and resample and test the water until acceptable results are obtained, all at no additional cost to the Owner.
5. The Contractor shall submit a Disinfection report detailing the following:
    a. Type and form of disinfectant used.
    b. Date and time of disinfectant injection start and time of completion.
    c. Test locations.
    d. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
    e. Date and time of flushing start and completion.
    f. Disinfectant residual after flushing in ppm for each outlet tested.
6. The Contractor shall submit a Bacteriological Report detailing the following:
    a. Date issued, project name, and testing laboratory name, address, and telephone number.
    b. Time and date of water sample collection.
    c. Name of person collecting samples.
    d. Test locations.
    e. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
    f. Coliform bacteria test results for each outlet tested.
    g. Certification that water conforms, or fails to conform, to bacterial standards.
7. Contractor shall note that work under this Contract shall NOT be considered completed until satisfactory installation and testing of the water mains have been completed.

3.8 FINAL INSPECTION

A. Final inspection and acceptance of pipe, valves, appurtenances, and precast concrete structures shall be made by the Owner's Representative and the utility owner having jurisdiction of the particular system. Prior to placing the systems in service all components shall be inspected, with the Owner’s Representative present, to insure that no debris or other contaminants are present. If necessary, the Contractor shall clean the structures and flush piping.

B. The Contractor is responsible for coordinating and scheduling the inspection of the work by local jurisdictional authorities. No additional payment will be made for inspections and permits required in the performance of the work.

END OF SECTION 331000

SECTION 33 30 00

SANITARY SEWERAGE UTILITIES

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of Specifications.

1.2 DESCRIPTION OF WORK

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

1. Sanitary sewage system piping, structures and appurtenances from a point ten (10) feet outside the building to the point of disposal.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 311000 – SITE CLEARING for site clearing, removal of trees, stumps and other vegetation, topsoil stripping, stockpiling and clearing and grubbing.

2. Section 312000 – EARTH MOVING for excavation, backfill, and compaction required for sanitary sewerage system piping and structures.

3. Section 333600 – UTILITY SEPTIC TANKS for septic system requirements.

4. Section 221316 – SANITARY WASTE AND VENT PIPING for building sanitary drains.

1.3 SUBMITTALS

A. Refer to Section 013300 – SUBMITTAL PROCEDURES for submittal provisions and procedures.

1. Descriptive literature showing pipe dimensions, pipe and joint materials and dimensions, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.

2. Product Data: Submit manufacturer's technical product data and installation instructions for pipe fittings, couplings, and appurtenances.

3. Shop Drawings: The precast concrete structure shop drawing submittals for the manholes, septic tanks, tight tank, and grease trap shall contain erection drawings showing connections, cast-in items, waterproofing details, lifting hooks, and production drawings showing elevations, sections and details indicating sizes and quantities of reinforcement. For manholes, shop drawings shall indicate orientation, size, and elevation of openings. Submit shop drawings for structure frames and covers.

4. Material Certificates: Provide copies of material certificates signed by material producer

and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

5. Prior to the acceptance of the sanitary sewerage system, the Contractor shall submit to the Engineer, for review and approval, a system As-Built Plan stamped by a Professional Land Surveyor. As-Built Plans shall be prepared using AutoCAD Release 14 or higher. The Owner's Representative will furnish to the Contractor an AutoCAD electronic file.

1.4 REFERENCE STANDARDS

A. The following standards are applicable to the work of this Section to the extent referenced herein:

1. ASTM: American Society for Testing and Materials.

2. ANSI: American National Standards Institute.

3. Commonwealth of Massachusetts Plumbing Code, latest edition.

4. Commonwealth of Massachusetts State Environmental Code Title V, 310 CMR 15.00, latest revision.

5. Local Board of Health Regulations

1.5 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.6 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems.

B. Utility Compliance: Comply with local utility owner's regulations and standards pertaining to sanitary sewerage system installation and inspection.

1.7 PROJECT CONDITIONS

A. Site Information: Perform site inspection and survey, research utility records, and verify existing utility locations and elevations. Verify that sewerage system piping may be installed in compliance with Contract Drawings and referenced standards.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate with interior building sanitary sewerage system piping.

B. Coordinate with other utility work.

C. The Contractor is responsible for developing a sequence of work to maintain existing services in

operation until the new services are operational.

D. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

PART 2 – PRODUCTS

2.1 PRECAST CONCRETE VAULTS AND TANKS

A. The precast reinforced concrete vault and tank structures shall be designed by a Massachusetts Registered Professional Engineer employed by the Contractor, in accordance with the applicable sections of the following references:

1. Commonwealth of Massachusetts State Building Code, latest edition.

2. American Concrete Institute, ACI 318 "Building Code Requirements for Reinforced Concrete."

3. AASHTO, "Standard Specifications for Highway Bridges."

4. Precast Concrete Institute, "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products, MNL-116."

B. The structures shall be designed for the following loads and possible combinations thereof:

1. Lateral soil pressure = 60 PCF (H), where H is the height from grade, as shown on the Contract Drawings, to the point of the structure being considered.

2. Soil weight shall be assumed to be 120 PCF.

3. AASHTO HS-20-44 loading.

4. Weight of precast concrete structure.

5. Initial handling and erection loadings, including design of galvanized lifting hooks using a safety factor = 4.0.

C. Investigate buoyancy and soil bearing considerations assuming the groundwater elevation is one-foot below the ground surface.

D. Concrete shall have a minimum 28 day compressive strength of 5,000 psi using Type II or III Portland cement with 8% maximum content of tricalcium aluminate, ASTM C150. A "normal dosage" of air-entraining agent shall be added to the concrete during the mixing cycle. Reinforcement shall be deformed billet-steel ASTM A615 or 7-wire strand ASTM A416, Grade 270 (if prestressed).

E. Dimensions and opening sizes and locations shall be as indicated on the Contract Drawings.

F. All concrete surfaces shall have a smooth finish, and the outside of the structures shall be coated with two coats of bituminous dampproofing. Bituminous dampproofing materials shall comply with Federal Specification SS-A-701. Each coat shall be applied at a rate of 65-square feet per gallon.

2.2 MANHOLES

A. General: Provide precast reinforced concrete structures as indicated and complying with ASTM C 478.

B. Manhole Top: Precast concrete, of concentric cone, eccentric cone, or flat slab top type, as indicated in the Contract Drawings. Tops shall be designed to meet H20 loadings.

C. Base and Riser Sections: Precast concrete, with base riser section with integral floor. Diameter, base and riser thicknesses shall be as indicated on the Contract Drawings.

D. Cement: Type II.

E. Concrete strength: 4,000 psi minimum.

F. Horizontal Joints: Joints between sections of concrete structures shall be sealed with a self-sealing butyl rubber based flexible joint sealant gasket complying with ASTM C443. Sealant shall be installed in accordance with the manufacturer's written instructions.

G. Manhole Steps and 1/2-inch grade 60 steel reinforcing rod conforming to ASTM A615 encapsulated with molded copolymer polypropylene. Rungs shall have a 14-inch-wide stepping surface and protrude no more than 6 inches from the wall, M.A. Industries type PS-2-PR-SL or equal. Copolymer polypropylene shall be type II, grade 16906, meeting ASTM specifications D 4101. The portion of the legs to be embedded in the precast section shall have fins and be tapered to ensure a secure bond. Steps shall start a foot above the shelf of the manhole floor and continue twelve inches on center spacing up through the complete height of the unit. The steps shall finish no lower than twenty-four (24)-inches below the rim elevation.

H. Pipe Connections: Sewer manhole pipe openings shall have integral flexible rubber sleeves capable of accepting the pipe connection.

I. Bituminous Dampproofing: Sewer manholes shall receive two coats of bituminous dampproofing, which complies with Federal Specification SS-A-701. Each coat shall be applied at a rate of 65-square feet per gallon.

J. Sanitary Sewer Brick Masonry: Bricks shall be sound, hard, uniformly burned, regular, and uniform in shape and size. Underburned or salmon brick shall not be acceptable. Only whole brick shall be used.

1. Bricks for channels and shelves shall conform to ASTM C32, Grade SS except that the mean of five tests for absorption shall not exceed 8 percent and no individual brick exceed 11 percent.

2. Bricks for raising manhole frames to finished grade shall conform to ASTM C62.

3. Mortar shall be composed of one part Portland cement, two parts sand, and hydrated lime not to exceed 10 lbs. To each bag of cement. Portland cement shall be ASTM C150, Type II; hydrated lime shall conform to ASTM C207.

4. Sand shall be washed, cleaned, screened, well-graded with all particles passing a No. 4 sieve, and conform to ASTM C33.

K. In sewer manholes, the invert channel within the structure shall be an inverted arch with bricks laid as stretchers and on edge and so constructed as to conform in shape to the lower half of the pipe. The shelf in manholes shall consist of bricks laid flat and the top of the shelf shall be at the elevation of the top of the pipe, as indicated on the Contract Drawings, and shall be sloped to flow

toward the channel.

L. Inverts in sewer manholes shall conform accurately to size of the adjoining pipe. Side inverts and main inverts where the direction changes shall be laid out in smooth curves of the longest possible radius which is tangent, within the manhole, to the centerline of the adjoining pipe lines.

M. When installing manholes on existing lines and when flows cannot be diverted, drop-over manholes shall be used. Drop-over manholes shall be precast with opening cast in the sidewalls of sufficient size to fit over the existing line(s) to remain in service. Drop-over manholes shall be set on a precast or cast-in-place concrete base slab. Drop-over manholes shall be manufactured to the same requirements and dimensions as standard manholes.

2.3 CONCRETE BLOCK MANHOLES

A. Concrete block manholes shall only be utilized when it is not feasible to utilize a precast concrete manhole and then only with written approval from the Owner's Representative.

B. Concrete block manholes shall be minimum 48 inches inside diameter and built of standard solid manhole barrel blocks set on a concrete or precast sectional plate base. The upper 2 feet of masonry shall be built using batter blocks. All joint spaces shall be completely filled, horizontal and vertical. All block to be thoroughly wet before jointing. A leveling course of two bricks at the top shall be used to meet proper grade. Cement concrete blocks shall be machine-made solid segments conforming to the requirements for Concrete Masonry Units for Construction of Catch Basin and Manholes, ASTM-C-139. Blocks shall be 6 inches in width with the inside and outside surfaces curved to the necessary radius and so designed that the interior surfaces of the structures shall be cylindrical. The top batter courses shall be designed to reduce uniformly the inside section of the structure to the top size and shape. The blocks used in the top courses shall be designed to produce a surface 8 inches in width upon which to seat the frame.

2.4 MANHOLE FRAMES AND COVERS

A. Frames and covers shall be of cast iron conforming to the requirements of ASTM A48, Class No. 30 and shall be manufactured by LeBaron Foundry, Inc. Brockton, Massachusetts, Neenah Foundry Company, Neenah, Wisconsin, Mechanics Iron Foundry Company, Roxbury, Massachusetts, or equal. Manhole covers shall be machined to fit securely and evenly on the frame. Frames and covers shall be designed to accept H20 loads, have a diamond surface finish, and frame height of 6 to 9-inches. Covers shall bear the word "SEWER" in 3-inch-high letters.

2.5 PVC PIPE

A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.

B. PVC SEWER PIPE

1. PVC (Polyvinyl Chloride) Gravity Sewer Pipe: ASTM D3034, SDR 35, for elastomeric gasket joints. Pipe 18 to 27 inches in diameter shall conform to ASTM F679, T-1 heavy wall.

a. Fittings: Elastomeric joints complying with ASTM D3212 using elastomeric seals complying with ASTM F477.

C. PVC CONDUIT

1. PVC Schedule 40: Provide PVC pipe Schedule 40 where shown on the Contract Drawings. Pipe shall comply with ASTM D1785 and be manufactured from virgin PVC plastic conforming to ASTM D1784. Pipe shall be Underwriter's Laboratories listed for use in underground installations.

   a. Joints and solvent cements shall conform to ASTM 2564.

2.6 CLEANOUTS

A. General: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.

2.7 IDENTIFICATION

A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils minimum thickness, with continuously printed caption in black letters "CAUTION - xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer, Storm Sewer
White	Proposed Excavation

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

A. General Locations and Arrangements: Contract Drawings indicate the general location and arrangement of the underground sanitary sewer system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical. Any modifications to the layout of the sewer system shall be submitted to the Engineer for review and approval at least five days prior to the start of the affected work.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations, accepted practices, and utility owner's requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use manholes for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited without

the written approval of the Engineer.

E. Install piping pitched down in direction of flow, at minimum slope of 1/4-inch per foot, except where indicated otherwise on the Contract Drawings.

F. Extend sanitary sewerage system piping to connect to building sanitary drains, of sizes and in locations indicated on the Contract Drawings.

3.2 CONCRETE STRUCTURES

A. The bases shall be supported on a compacted level foundation of gravel borrow a minimum 12 inches thick. Crushed stone may be substituted for gravel borrow if field conditions at the bottom of the excavation are wet.

1. Manhole risers and tops shall be installed using approved butyl-rubber type gasket for sealing joints of manhole risers and tops; jointing shall be performed in accordance with the manufacturer's recommendations. Manhole risers and tops shall be installed level and plumb. Water shall not be permitted to rise over newly made joints, nor until after inspection as to their acceptability. All jointing shall be done in a manner to ensure watertight joints. Openings shall be provided in the precast concrete manhole risers to receive entering pipes and these openings shall be made at the place of manufacture. Connection of sanitary pipes to manholes shall be made by means of a flexible rubber sleeve/boot cast integral with the structure sidewall.

2. Care shall be taken to ensure the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Manhole risers and tops shall be installed so the manhole steps shall be in alignment.

3. All holes used for handling shall be thoroughly plugged with non-shrink grout.

4. Cutting or tampering in the field, for purpose of creating new sidewall openings or altering existing openings, will not be permitted without approval of the Engineer.

5. Clean all debris, mortar, and soil from the bottom of all structures prior to final acceptance of the project.

3.3 STRUCTURE REBUILT

A. When in the opinion of the Engineer or Owner's Representative, an existing masonry structure walls show deterioration, the structure shall be rebuilt. The casting and deteriorated masonry shall be removed in a careful and neat manner until only a sound condition remains. Concrete blocks shall be used to rebuild the structure. The new masonry construction, replacing of the casting, and other incidental work shall be performed as specified above.

3.4 INSTALLATION OF TANKS

A. If precast tank sections are to be field assembled, adequate waterproofing shall be used at the joint to resist the waterhead at that joint.

B. Structure shall be supported on a compacted level foundation of gravel borrow a minimum of 12 inches thick.

3.5 SETTING MANHOLE FRAMES AND COVERS

A. Manhole frames shall be set with tops conforming accurately to the grade of the pavement or

finished ground surface as indicated on the Contract Drawings or as directed. Frames shall be set concentric with the top of the manhole on a minimum of two courses of brick and a maximum of four courses in a full bed of mortar so the space between the top of the brick and mortar and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the concrete shall be placed all around the bottom flange. The mortar shall be smoothly finished to a height of 5 inches above the flange.

1. Only clean bricks shall be used in brick work to adjust frame elevations. The brick shall be moistened by suitable means.

2. Manhole covers shall be left in place in the frame until completion of other work at the manholes.

3. Frame castings for catch basins shall be set on a minimum of two courses of brick and a maximum of four courses in full mortar beds true to line and grade. Frames shall be set in a grout bed and the cement mortar shall be brought up to a height of not less than 5 inches above the bottom of the frames and made watertight. The castings of structures located within the pavement area shall not be completely set to the established grade until the bottom course of pavement has been laid. The final setting of all casting shall be performed at the proper stage of construction as required by the Contractor's operations. No additional payment will be made for adjusting and resetting of any casting.

3.6 PVC PIPE

A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

B. PIPE HANDLING

1. All pipe and fittings shall be carefully handled from the truck onto the ground and into the trench or excavation so as to prevent damage to the pipe. Pipes shall be kept free of dirt and foreign material especially on the inside. Joint ends of pipe shall especially be kept clean.

2. Pipe stored on site shall be protected from direct sun light and suitably ventilated.

3. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.

C. ALIGNMENT AND PLACEMENT OF PVC PIPE

1. Bedding material for the pipe must be installed with care in the area around the pipe. Bedding material must be placed to provide uniform and adequate support under pipe. Do not use blocking to bring pipe up to grade.

2. Provide bell holes at each joint to permit joint to be assembled properly while maintaining uniform pipe support.

3. Place and consolidate the bedding material under the pipe haunch to provide adequate side support while avoiding both vertical and lateral displacement of pipe.

4. Initial backfill must be completed to a point at least 12-inches over the top of the pipe and be hand placed. Use little or no tamping of initial backfill directly over the top of pipe. Compaction methods may be utilized during final backfilling.

5. Jointing of PVC sewer pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The bell end of the pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be lubricated prior to making up the joint. The position of the gasket shall be checked to insure the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.

6. When jointing PVC conduit pipe, it shall be cut square, conduit ends cleaned, an even coating of solvent cement applied to the pipe end and socket, and the conduit firmly pushed together until the conduit bottoms in the socket. The conduit shall be rotated 1/4 turn immediately after bottoming in the socket to ensure even spread of the cement.

7. Detectable warning tape shall also be installed 2-feet below the existing ground surfaces for later use in locating the pipe's exact position.

3.7 CLEANOUTS

A. Install cleanouts and extensions from sewer pipe to grade as indicated on the Contract Drawings. Set cleanout frame and cover in concrete 12 by 12 by 6-inches deep, except where location is in bituminous or concrete paving. Set top of cleanout 1-inch above surrounding earth grade or flush with grade when installed in paving.

3.8 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work.

B. Make branch connections from side into existing piping by installing a saddle or wye as indicated on the Contract Drawings.

C. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.

3.9 INSTALLATION OF IDENTIFICATION

A. Install continuous plastic underground warning tape during back-filling of trench for underground sanitary sewerage system piping. Locate tape two-feet below finished grade, directly over piping.

3.10 FIELD QUALITY CONTROL

A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction and the following:

1. Testing shall be witnessed by the Owner’s Representative and the local authority.

2. All sewers shall be tested for leakage by an infiltration test if the groundwater level is a minimum of two feet above the crown of the pipe for the full length of the section to be tested.

3. Where sewers cannot be tested by an infiltration test as specified above, they shall be tested by an exfiltration test using air as specified in a document entitled, "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe”, by UNI-BELL PVC Pipe Association dated July, 1998 (UNI-B-6-98).

B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work

progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.

2. Place plugs in ends of uncompleted pipe at end of day or when work stops.

3. Flush piping between manholes to remove collected debris.

C. Interior Inspection: If deemed necessary by the Owner's Representative inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes has been installed and approximately 2 feet of backfill is in place, and again at completion of project.

2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, the Contractor shall correct such defects and reinspect.

D. Prior to acceptance of the sanitary sewerage system the Contractor shall submit to the Engineer for review a system As-Built Plan stamped by a Professional Land Surveyor Registered in the Commonwealth of Massachusetts and the results of the leakage tests. Prior to putting the system into service all structures shall be inspected, with the Owner's Representative present, to insure that no debris or other contaminants are present. If necessary clean structures and flush piping.

3.11 BACKFILLING

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed, all in accordance with local requirements and the contract documents.

B. Initial backfill shall be placed evenly on both sides of the pipe to distribute the load and not to cause movement or deflection of the pipe.

3.12 FINAL INSPECTION

A. Final inspection and acceptance of pipe, valves, appurtenances, hydrants and precast concrete structures shall be made by the Owner's Representative and the utility owner having jurisdiction of the particular system. Prior to placing the systems in service all components shall be inspected, with the Owner's Representative present, to insure that no debris or other contaminants are present. If necessary, the Contractor shall clean the structures and flush piping.

B. The Contractor is responsible for coordinating and scheduling the inspection of the work by local jurisdictional authorities. No additional payment will be made for inspections and permits required in the performance of the work.

END OF SECTION 33 31 00

SECTION 333600
UTILITY SEPTIC TANKS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of Specifications.

1.2 DESCRIPTION OF WORK

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

1. Installation of Septic Tank and Grease Trap.

2. Appurtenant Piping.

B. Related Work: The following items are not included in this section and will be performed under the designated section:

1. Section 312000 – EARTH MOVING for excavation and backfill.

2. Section 260000 – ELECTRICAL for power wiring to pumps, etc.

3. Section 220000 – PLUMBING for building sewers.

1.3 SUBMITTALS

A. Refer to Section 013000, SUBMITTALS for submittal provisions and procedures.

1. Material Certificates: Provide copies of material certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

2. Product Data: Submit manufacturer's technical product data and installation instructions for septic system's materials and products.

3. Shop Drawings: Submit shop drawings for septic system, showing pipe materials, size, locations, and inserts. Include details of underground structures, connections, and cleanouts. Show interface and spatial relationship between piping and nearby structures.

4. The Contractor shall submit buoyancy calculations for sanitary sewer structures prepared and sealed by a professional Civil Engineer and licensed in the state of Massachusetts. The buoyancy calculations shall be prepared for the conditions indicated within Section 333000, WASTEWATER COLLECTION.

5. Record/As-Built Drawings: At project closeout, submit record drawings of installed septic systems, showing exact location and inverts of septic tank(s), pump station, distribution box, soil absorption system and underground structures. As-Built Drawings shall indicate the true measurement and location, horizontal and vertical,

of all new construction. As-Built Drawings shall include a minimum of three (3) ties to each manhole from fixed permanent objects. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor and Licensed Professional Engineer. The as-built plans shall also be submitted electronically as an AutoCAD drawing file (release 2002 or higher).

6. Maintenance Data: Submit maintenance data and parts lists for septic system materials and products. Include this data, product data, shop drawings and record drawings in maintenance manual.

7. Material Certificates: Provide copies of material certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.4 REFERENCE STANDARDS

A. The following standards are applicable to the work of this Section to the extent referenced herein:

1. ASTM: American Society for Testing and Materials.

2. Commonwealth of Massachusetts Plumbing Code, latest edition.

3. Commonwealth of Massachusetts State Environmental Code Title V, 310 CMR 15.00, latest revision.

4. Local Board of Health Regulations

5. Commonwealth of Massachusetts, Massachusetts Highway Department (MHD), Standard Specifications for Highways and Bridges, latest English Edition with amendments, hereinafter referred to as the “Standard Specifications.” All references to method of measurement, basis of payment and payment items in the Standard Specifications are hereby deleted. References made to particular sections or paragraphs in the Standard Specifications shall include all related articles mentioned therein.

1.5 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

1.6 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems.

B. Utility Compliance: Comply with local utility owner’s regulations and standards pertaining to

sanitary sewerage system installation and inspection.

C. Place barricade around soil absorption field for duration of construction project to prevent construction vehicles from being driven across field. Comply with all notes shown on the Contract Drawings for septic system construction.

1.7 PROJECT CONDITIONS

A. Site Information: Perform site inspection and survey, research utility records, and verify existing utility locations and elevations. Verify that sewerage system piping may be installed in compliance with Contract Drawings and referenced standards.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate with interior building sanitary sewerage system piping.

B. The 17,000-gallon septic tank, 4,000-gallon grease trap, and 8,000-gallon dosing/pump chamber shall be installed prior to the new building completion. Dates of installation shall be coordinated and confirmed with owner.

C. Coordinate with other utility work.

D. The Contractor is responsible for developing a sequence of work to maintain existing services in operation until the new services are operational.

E. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

A. Underground-Type Plastic Line Marker: Manufacturer's standard, permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6-inches wide x 4-mils thick. Provide green tape with black printing reading "CAUTION SEWER LINE BELOW".

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering identification markers which may be incorporated in the work include: Repnet, Inc.; Emed Co., Inc., Seton Name Plate Corp., or approved equal.

2.2 SEPTIC TANK

A. General: Provide two 10,000 gallon septic tanks of dimensions and capacity as indicated on the Contract Drawings. Septic tanks shall be Old Castle Precast, E.F.Shea, Scituate Precast or approved equal. Tanks shall be HS20-44 loading.

B. Manholes: Provide a minimum of three (3) 24-inch diameter access manholes on each septic tank with castings to grade in the locations shown on the Contract Drawings.

1. Castings shall be watertight and be equivalent to E.L. LeBaron No. LBW288-3 marked "SEWER", Neenah Foundry Co., No. R-1755-F2 marked “SEWER” or approved equal from United States Foundry Inc.

C. Inlet and Outlet Fittings: Provide inlet and outlet tees in the septic tank at the elevations shown on the Contract Drawings.

2.4 DOSING CHAMBER

A. General: Provide dosing tank of dimensions and capacity as indicated on the Contract Drawings. Dosing chamber dimensions shall be equivalent to E.F. Shea 14,000 gallon Commercial Line Tank with an inside height of as shown on the Contract Drawings. Tanks shall be HS20-44 loading.

B. Access Hatch: Provide aluminum access hatch over the main pump chamber. Access hatch shall be installed in the flat top of manhole structure as shown on the Contract Drawings. Hatch shall be installed at finish grade.

1. Access hatch shall be aluminum and equivalent to L. W. Products, Thompson Fabricating, U.S.F. Fabrication or approved equal. Hatch shall have opening dimensions of 36-inches by 48-inches minimum. Hatch shall be watertight and be able to withstand HS20-44 loading.

C. Inlet and Outlet Fittings: Provide watertight inlet and outlet connections at the elevations shown on the Contract Drawings.

2.5 DOSING CHAMBER PUMP SYSTEM

A. Equipment

1. Pumps (main, 14,000 gal pump chamber): Contractor shall install two pumps which shall be non-clog submersible pumps with 6-inch discharge. Both pumps shall be non-clog submersible pumps with 6-inch discharge; 7.5 HP, xx Volt, xx RPM, three phase motor; solids handling capability of 3 3/16 inches; cast iron motor housing conforming to ASTM A48-76; enclosed 2-vane impeller made of cast iron complying to ASTM A536-80; and a single, type 21 carbon/ceramic mechanical seal. Provide a duplex assembly.

2. Guide Rails: Guide rails shall be stainless steel pipe mounted to the concrete chamber. The lift out rail system shall be compatible with the pumps in the dosing/pump chamber.

3. Piping: The piping in the dosing chamber shall be flanged ductile iron. The discharge risers from the two pumps shall be connected outside the dosing chamber such that there is a single discharge from the dosing chamber exiting the chamber with at least 5 feet of cover. Force main outside chamber shall be PVC SDR 21. Contractor shall supply necessary fittings to make the transition from cast iron to PVC.

4. Float switches shall be Myers MFS Series or equal with 20-feet of cable. Provide float switches at the elevations shown on the Contract Drawings and one mounting bracket.

5. Duplex control panel: The same company as the pump and rail system shall manufacture the control panel. The duplex control panel shall be mounted as

indicated on the Contract Drawings. Equipment mounted in the control panel shall include: steel back panel, IEC motor starters with 3-pole bi-metal overload relay for each pump, pump circuit breakers, control circuit fuse, alarm circuit fuse, control circuit breaker, control circuit transformer, two hand-off-auto switches, alarm test switch, two pump run lights, terminal blocks, ground lugs, flashing alarm light, full inner door, overload reset button, override relay, and alternator relay.

6. Control System: The control system for the dosing chamber shall have the capability to perform the following tasks: start one pump on high level, turn the operating pump off when the level reaches a low level, start the second pump and activate an alarm when the level reaches a high water level, and activate an alarm condition if the water level reaches a low level in the chamber. All levels shall be activated by float switches placed at the elevations shown on the Contract Drawings. The control panel also shall be capable of alternating starts between the pumps. The high water alarm condition shall activate an alarm horn and an alarm beacon mounted on the top of the control panel. The Contractor shall also provide the following additional features on the control panel: elapsed time meter for each pump, convenience outlet, lightning arrestor, and low level cut-off. Within the control panel lights shall be provided and labeled for each of the alarm conditions to make it possible to determine what caused the alarm. The Contractor is responsible for providing a fully functioning system as described.

7. Alarm Signaling: The contractor shall provide alarm signaling from the dosing chamber control panel to the annunciator panel mounted in the mechanical room of the building. Any and all alarm conditions from the dosing chamber shall be relayed to the annunciator panel as a single "Dosing Chamber Alarm Condition."

2.6 ANNUNCIATOR PANEL

A. Provide and install an annunciator panel. The annunciator panel shall be mounted in the location determined by the owner. The same manufacturer as the control panels for the dosing chamber and the tight tank shall manufacture the annunciator panel. The annunciator panel shall have red lights mounted on the front cover for the following conditions:

1. "Dosing Chamber Alarm Condition."

B. The lights on the panel shall each possess a reset button to clear the alarm.

PART 3 - EXECUTION

3.1 PREPARATION OF FOUNDATION FOR BURIED PIPE SYSTEMS

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid, and backfill with clean sand or washed stone to the indicated level on the Contract Drawings.

C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.2 GENERAL INSTALLATION

A. General Locations and Arrangements: The Contract Drawings (plans and details) indicate the general location and arrangement of the underground sanitary sewerage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use manholes for changes in direction of gravity lines and at one hundred (100) foot intervals, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

E. Install piping pitched down in direction of flow, at minimum slope of ¼-inch per foot, except where indicated otherwise on the Contract Drawings.

F. Extend sanitary sewerage system piping to connect to building sanitary drains, of sizes and in locations indicated.

3.3 INSTALLATION OF IDENTIFICATION

A. General: During back-filling/top-soiling of septic system's piping and components, install continuous underground-type plastic line marker, located directly over buried lines and leaching field perimeter at 6-feet to 8-inches below finished grade.

3.4 LEACHING TRENCHES

A. Grading: Place piping at elevations noted on the Contract Drawings.

B. Piping: Lay piping solidly bedded in filtering material. Provide full bearing for each section throughout its length, to true grades and alignment.

C. At the end of each pressure distribution lateral, there shall be installed a long elbow and riser, with a threaded plug located within a gate box riser, with cover at finish grade for inspection and cleanout purposes. Additional threaded extension risers shall be provided for purposes of measuring the distal pressure at times as may be required. Access ports shall be provided at the end of each lateral at .

D. A groundwater monitoring well shall be installed in the center of the leaching area of construction to be approved by the Board of Health agent.

E. Leaching trench vents shall be equipped with odor control in the form of an activated carbon filter with capability for easy replacement of media. Vent pipe headers for trench systems shall be, at a minimum, above the crown elevation of the end of the distribution piping.

F. Perforated observation pipes shall be installed to the bottom of the leaching interface of all segments of the leaching area, extended to within 6 inches of finished grade with a cap for those located in grass surface. For those observation pipes located within paved areas, observation pipes shall be located within a gate box with the cover at finish grade. Contractor shall install a minimum of 2 per trench.

G. After piping has been installed, place additional filtering material around sides and top to compacted depth as indicated on the Contract Drawings.

H. Testing Lines: Test and check piping before backfilling. Remove obstructions, replace damaged components, and retest system until satisfactory.

I. Backfilling: Immediately backfill field with the proper material, mounding but not compacting soil to the indicated elevations. Do not permit construction equipment on backfilled trenches.

3.5 INSTALLATION OF TANK(S)

A. General: Install as indicated on the Contract Drawings, and in accordance with the manufacturer's installation instructions.

B. Tests: Fill tank(s) with water and let stand overnight. If water level recedes, locate and repair leaks, and retest at no cost to Owner. No leakage is allowed.

3.6 INSTALLATION OF PUMP SYSTEM

A. General: Install all equipment in accordance with manufacturer's instructions.

B. Chamber: Install precast chambers on a 12-inch minimum thickness of crushed stone. The chambers shall be set level and plumb.

C. Equipment: Install all chamber equipment in accordance with manufacturer's instructions. Seal chamber penetrations with non-shrink grout.

D. Force Main: Install force main to the distribution manifold as shown on the Contract Drawings. Lay piping at a slope(s) that will not create high or low points between the dosing chamber and the manifold.

E. Testing: Notify the Engineer at least 24 hours prior to testing. Provide the services of a manufacturer's trained technician to start-up and test the systems. Pumps shall be throttled with the gate valves to create sufficient TDH to reduce discharge rate as required. The performance of the system for lead pump, lag pump, high water alarm, and alternation, and reset shall be demonstrated to the satisfaction of the Engineer.

3.7 FIELD QUALITY CONTROL

A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction. Prior to backfill of the pressure dosed soil absorption area, a clear water test shall be conducted on the pump and pressure distribution system in the presence of the designer and the Board of Health Agent. The distal pressure shall be no less than 2.5 feet and no more than 7 feet. The respective distal pressures shall not vary more than 5% from the mean pressure of all laterals. No valve throttling or insertion of special orifices of the trench piping will be allowed to obtain the desired head.

B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.

2. Flush piping between manholes, if required by local authority, to remove collected debris.

C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2-feet of backfill is in place, and again at completion of project.

2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, the Contractor shall correct such defects at no cost to the Owner and re-inspect.

3. Prior to acceptance of the sanitary sewerage system, the Contractor shall submit to the Engineer for review a system As-Built Plan stamped by a Professional Land Surveyor Registered in the Commonwealth of Massachusetts.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of Specifications.

1.2 DESCRIPTION OF WORK

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

1. Polyvinyl chloride pipe.

2. Corrugated polyethylene pipe.

3. Drainage vaults, tanks, catch basins, and manholes

4. Area drains and trench drains

5. Water quality structures

B. Related Work: The following items are noted and included in this Section and will be performed under the designated sections:

1. Section 31 20 00 – EARTH MOVING for excavation, backfill, & compaction requirements.

2. Section 22 14 00 – FACILITY STORM DRAINAGE for building storm drainage piping.

1.3 SUBMITTALS

A. Refer to Section 01 33 00 – SUBMITTAL PROCEDURES, for submitted provisions and procedures.

1. Product Data: Submit manufacturer's technical product data and installation instructions for storm drain system materials and products. Descriptive literature showing pipe dimensions, pipe and joint materials and dimensions, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.

2. Submit shop drawings for storm drain systems, showing piping and manhole materials and sizes. Submit shop drawings of complete layout of detention/retention structures, including all fittings and appurtenances.

3. The precast concrete structure shop drawing submittals for the manholes, catch basins, vaults, and tanks shall contain erection drawings showing connections, cast-in items, waterproofing details, lifting hooks, and production drawings showing elevations, sections and details indicating sizes and quantities of reinforcement.

4. For manholes, clock diagrams shall be submitted indicating orientation, size, and elevation of

openings for each manhole structure.

5. Submit shop drawings for structure frames, grates, and covers.

6. Filter fabric: Submit the manufacturer's information and a one square foot representative sample of the filter fabric.

7. The Contractor shall submit buoyancy calculations for storm drainage structures prepared and sealed by a professional Civil Engineer and licensed in the state of Massachusetts.

8. Record Drawings: Prior to the acceptance of the storm drainage system, the Contractor shall submit to the Engineer, for review and approval, As-Built Drawings that indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built Drawings shall include a minimum of three (3) ties to each structure from fixed permanent objects. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor and Licensed Professional Engineer. The as-built plans shall also be submitted electronically as an AutoCAD drawing file (release 2002 or higher).

1.4 REFERENCE STANDARDS

A. The following standards are applicable to the work of this Section to the extent referenced herein:

1. ASTM: American Society for Testing and Materials.

2. ANSI: American National Standards Institute.

3. AASHTO: American Association of State Highway and Transportation Officials

4. Reference is made herein to the Commonwealth of Massachusetts, Department of Transportation (MassDOT), Formerly Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, latest edition, hereinafter referred to as the "Standard Specifications". All references to method of measurement, basis of payment, and payment items in the "Standard Specifications" are hereby deleted. References made to particular sections or paragraphs in the "Standard Specifications" shall include all related articles mentioned therein.

5. Commonwealth of Massachusetts, Massachusetts Highway Department, Construction Standards, latest Edition with amendments, hereinafter referred to as the “Construction Standards.”

6. Plumbing Code Compliance: Comply with applicable portions of Massachusetts Plumbing Code and National Standard Plumbing Code, latest editions, pertaining to selection and installation of storm drain system's materials and products.

7. Environmental Compliance: Comply with applicable portions of local Environmental Agency regulations pertaining to storm drain systems.

8. City/Town Regulations

1.5 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and

formed his own conclusions as to the full requirements of the work involved.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturing of storm drain system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

B. Installer's Qualifications: Firms with at least three years of successful installation experience on projects with storm drain work similar to that required for the project.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate with interior building storm drain system piping.

B. Coordinate with other utility work.

C. The Contractor is responsible for developing a sequence of work to maintain existing services in operation until the new services are operational.

D. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

PART 2 – PRODUCTS

2.1 PRECAST CONCRETE VAULTS AND TANKS

A. The precast reinforced concrete vault and tank structures shall be designed by a Massachusetts Registered Professional Engineer employed by the Contractor, in accordance with the applicable sections of the following references:

1. Commonwealth of Massachusetts State Building Code, latest edition.

2. American Concrete Institute, ACI 318 "Building Code Requirements for Reinforced Concrete."

3. AASHTO, "Standard Specifications for Highway Bridges."

4. Precast Concrete Institute, "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products, MNL-116."

B. The structures shall be designed for the following loads and possible combinations thereof:

1. Lateral soil pressure = 60 PCF (H), where H is the height from grade, as shown on the Contract Drawings, to the point of the structure being considered.

2. Soil weight shall be assumed to be 120 PCF.

3. AASHTO HS-20-44 loading.

4. Weight of precast concrete structure.

5. Initial handling and erection loadings, including design of galvanized lifting hooks using a

safety factor = 4.0.

C. Investigate buoyancy and soil bearing considerations assuming the groundwater elevation is one-foot below the ground surface.

D. Concrete shall have a minimum 28 day compressive strength of 5,000 psi using Type II or III Portland cement with 8% maximum content of tricalcium aluminate, ASTM C150. A "normal dosage" of air-entraining agent shall be added to the concrete during the mixing cycle. Reinforcement shall be deformed billet-steel ASTM A615 or 7-wire strand ASTM A416, Grade 270 (if prestressed).

E. Dimensions and opening sizes and locations shall be as indicated on the Contract Drawings.

F. All concrete surfaces shall have a smooth finish, and the outside of the structures shall be coated with two coats of bituminous dampproofing. Bituminous dampproofing materials shall comply with Federal Specification SS-A-701. Each coat shall be applied at a minimum thickness of 7 mils per coat and a total thickness of 14 mils; however, in no case shall the thickness per coat be less than that recommended by the manufacturer. Bituminous waterproofing shall be Carboline Bitumastic 300M as manufactured by SOMAY Products, Inc., Miami, FL; Sonnoshield HLM 5000 as manufactured by Sonneborn, Shakopee, MN, or approved equal.

2.2 MANHOLES AND CATCH BASINS

A. General: Provide precast reinforced concrete structures as indicated and complying with ASTM C 478.

B. Manhole Top: Precast concrete, of concentric cone, eccentric cone, or flat slab top type, as indicated in the Contract Drawings. Tops shall be designed to meet H20 loadings.

C. Base and Riser Sections: Precast concrete, with base riser section with integral floor. Diameter, base and riser thicknesses shall be as indicated on the Contract Drawings.

D. Cement: Type II.

E. Concrete strength: 4,000 psi minimum.

F. Horizontal Joints: Joints between sections of concrete structures shall be sealed with a self-sealing butyl rubber based flexible joint sealant gasket complying with ASTM C443. Sealant shall be installed in accordance with the manufacturer's written instructions.

G. Manhole Steps and 1/2-inch grade 60 steel reinforcing rod conforming to ASTM A615 encapsulated with molded copolymer polypropylene. Rungs shall have a 14-inch-wide stepping surface and protrude no more than 6 inches from the wall, M.A. Industries type PS-2-PR-SL or equal. Copolymer polypropylene shall be type II, grade 16906, meeting ASTM specifications D 4101. The portion of the legs to be embedded in the precast section shall have fins and be tapered to ensure a secure bond. Steps shall start a foot above the shelf of the manhole floor and continue twelve inches on center spacing up through the complete height of the unit. The steps shall finish no lower than twenty-four (24)-inches below the rim elevation.

H. Pipe Connections: Drainage structures shall have plain beveled openings to accept the type of pipe specified and to be sealed with non-shrink grout.

I. Drain manholes shall be constructed with drop connections when the proposed invert of the connection is at least 2.75 feet above the manhole invert. All drop manholes will be of the external type. The drop pipe shall be constructed of minimum SDR 35 PVC. The drop piping and horizontal cleanout sections will be sized the same as the drain main piping and shall enter the manhole at invert

elevation. The drop portion of the piping shall be secured with anchor straps. The drop piping shall be encased with control density fill.

J. Bricks for raising manhole frames to finished grade shall conform to ASTM C32 or as specified in MHD M4.05.

K. Inverts in drain manholes shall conform accurately to size of the adjoining pipe. Side inverts and main inverts where the direction changes shall be laid out in smooth curves of the longest possible radius which is tangent, within the manhole, to the centerline of the adjoining pipe lines.

L. Safety landings will be installed inside manholes greater than 16-feet in depth.

M. When installing manholes on existing lines and when flows cannot be diverted, drop-over manholes shall be used. Drop-over manholes shall be precast with opening cast in the sidewalls of sufficient size to fit over the existing line(s) to remain in service. Drop-over manholes shall be set on a precast or cast-in-place concrete base slab. Drop-over manholes shall be manufactured to the same requirements and dimensions as standard manholes.

2.3 CONCRETE BLOCK MANHOLES

A. Concrete block manholes shall only be utilized when it is not feasible to utilize a precast concrete manhole and then only with written approval from the Owner's Representative.

B. Concrete block drain manholes shall be minimum 48 inches inside diameter and built of standard solid manhole barrel blocks set on a concrete or precast sectional plate base. The upper 2 feet of masonry shall be built using batter blocks. All joint spaces shall be completely filled, horizontal and vertical. All block to be thoroughly wet before jointing. A leveling course of two bricks at the top shall be used to meet proper grade. Cement concrete blocks shall be machine-made solid segments conforming to the requirements for Concrete Masonry Units for Construction of Catch Basin and Manholes, ASTM-C-139. Blocks shall be 6 inches in width with the inside and outside surfaces curved to the necessary radius and so designed that the interior surfaces of the structures shall be cylindrical. The top batter courses shall be designed to reduce uniformly the inside section of the structure to the top size and shape. The blocks used in the top courses shall be designed to produce a surface 8 inches in width upon which to seat the frame.

2.4 MANHOLE FRAMES AND COVERS

A. Frames and covers shall be of cast iron conforming to the requirements of ASTM A48, Class No. 30 and shall be manufactured by LeBaron Foundry, Inc. Brockton, Massachusetts, Neenah Foundry Company, Neenah, Wisconsin, Mechanics Iron Foundry Company, Roxbury, Massachusetts, or equal. Manhole covers shall be machined to fit securely and evenly on the frame. Frames and covers shall be designed to accept H20 loads, have a diamond surface finish, and frame height of 6 to 9-inches. Covers shall bear the word "DRAIN" in 3-inch-high letters.

2.5 CATCH BASIN FRAMES AND GRATES

A. Frames and grates shall be of cast iron. Single and double frames and grates shall be equal to pattern No. LF 248-2 and LV2448-2, respectively, four and three flange as manufactured by LeBaron Foundry, Inc. Brockton, Massachusetts, Neenah Foundry Company, Neenah, Wisconsin, Mechanics Iron Foundry Company, Roxbury, Massachusetts, or equal.

B. Catch basin cascade frame and grates shall be Catalog No. LK 120D or LK 121D as manufactured by LeBaron Foundry Co., or approved equal. Water flowing from left to right requires a Right-Hand Grate. Water flowing from right to left requires a Left-Hand Grate.

2.6 CATCH BASIN HOODS

A. All catch basins shall have hoods installed over the outlet pipe. Hoods shall be cast iron removable or hinged traps that fit over the catch basin outlet pipe. Traps shall be approximately 15-inches wide by 15-inches high and extend 8 to 10-inches from the wall of the structure. Traps shall be Neenah R-3701, Catalog No. L202 as manufactured by LeBaron Foundry Co. or approved equal.

2.7 AREA DRAIN

A. Area drains required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified 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. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The pipe bell spigot shall be joined to the main body of the area drain. A PVC cap shall be installed at the bottom of the area drain sump. The pipe stock used to manufacture the main body and pipe stubs 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. Area drains shall be manufactured by Nyloplast or approved equal.

B. The grates furnished for area drains in lawn and bioretention areas shall be ductile iron grates and 24" in diameter and be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for area drains in paved areas shall be ductile iron and 12" square. Grates for area drains shall be capable of supporting H-25 wheel loading for in vehicular areas or H-10 loading in pedestrian only areas, unless otherwise noted. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron. Grates shall be provided painted black. Grates in walkways shall meet ADA requirements. Grates in planting beds shall be domed grates. Area drain grates shall be manufactured by Nyloplast or approved equal.

2.8 WATER QUALITY STRUCTURE

A. The water quality drainage structure models indicated on the Contract Drawings are Stormceptor® as manufactured by the Stormceptor Corporation, Rockville, MD. Equivalent structures include Vortechs as manufactured by Vortechnics, Inc. of Portland, ME, and Downstream Defender as manufactured by Hydro International of Portland, ME. Other acceptable equivalent manufactured devices may be used if following requirements are met. Prior to acceptance, the contractor shall receive written approval for use of said substitution from the Town of Lincoln and/or their authorized representatives.

B. The water quality structure shall have a proven laboratory test record of having the capability to remove a minimum of 80% of the sediment load from the low-flow storm conditions from the total catchment area of the drainage system. Laboratory testing methods shall conform to the "Technology Acceptance Reciprocity Partnership" (TARP) Tier II protocol or other acceptable equivalent method and shall have the capability of removing clay and silt size particles.

C. The available water quality structure laboratory performance documentation shall achieve a grade of "2" or better as rated through the "Massachusetts Stormwater Evaluation Project" (MAStep).

D. The water quality structure shall be installed underground as part of the stormwater system.

E. The water quality structure shall be designed to meet HS-20 loading.

F. The water quality structure shall be vertically oriented with easy access to facilitate maintenance.

G. The first 16 inches of oil storage should be lined with fiberglass or other coating acceptable to the Engineer to provide double-wall containment of any hydrocarbon-based material.

H. Water quality structure shall be equipped with high flow bypass that shall be physically separated from the separation area to prevent mixing.

I. The structure shall be maintainable from the surface via access points without requiring entry into the structure.

J. The structure shall be constructed of precast concrete components.

K. The structure shall be designed to prevent the formation of secondary eddy currents or scour conditions.

L. The structure shall be able to be installed to the invert elevations of the drainage system as detailed on the Contract Drawings.

M. The cover for the interceptor shall clearly indicate that it is an oil and sediment interceptor.

N. The water quality structure shall be capable of containing floatable substances such as oil and gasoline within the structure during normal operation as well as periods of service and repair. Floatables containment shall be achieved without the use of floatable additives.

O. The water quality structure shall not be compromised by backwater conditions i.e., trapped pollutants should not be resuspended and scoured from the interceptor during backwater conditions.

P. Calculations stamped by a Professional Engineer shall be supplied to demonstrate that the water quality structures will accept the design flow rates without causing a backwater condition.

2.9 DUCTILE IRON PIPE AND FITTINGS

A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.

1. Ductile iron pipe shall be that of a manufacturer who can demonstrate at least five years of successful experience in manufacturing ductile iron pipe. The pipe shall be equipped with push-on type, restrained joint, or mechanical joints, as required.

2. All ductile iron drain pipe shall conform to American Water Works Association (AWWA) C150 and AWWA C151.

3. The ductile iron pipe shall be Class 52 and furnished in minimum nominal 18-foot lengths, with Push-on or Mechanical Joints as manufactured by U.S. Pipe and Foundry Company, Atlantic States Cast Iron Pipe Co., Clow Corporation, or approved equal with gaskets conforming to AWWA C111 "Rubber Gasket Joints".

4. Ductile iron drain pipe shall be asphalt seal coated its exterior and interior surfaces in accordance with AWWA C104. The pipe shall be furnished along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.

5. Fittings shall be short body ductile iron Class 350 Mechanical Joint, conforming to ANSI Specification AWWA C153, latest edition, for pipe sizes 16-inches and smaller, and Class

350 standard Mechanical Joint fittings conforming to AWWA C110, latest edition, for pipe sizes 16 through 24-inches, unless specifically stated otherwise in the Specifications or on the Contract Drawings. Fittings shall have the same lining and coating as the pipe specified above. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends. Fittings greater than 24-inches shall be as specified above except they shall be Class 250.

6. Contractor shall provide all adapters and fittings such as transition couplings, as determined in the field, necessary to complete all cross-connections, whether or not specifically stated in the Contract Drawings and Specifications.

7. All pipe shall be marked with the class, thickness designation and initials of the manufacturer.

8. If required the manufacturer shall supply the Engineer with certificates of compliance with these Specifications and certification that each piece of ductile iron pipe has been tested at the foundry with the Ball Impression Test, Ring Bending, or equal.

9. Pipe for use with split couplings shall be as specified except that the ends shall not have bells or beads but shall have cast or machined shoulders or grooves as necessary for the couplings to be used and shall conform to the specifications of the manufacturer of the couplings. If split couplings are used with grooved ductile-iron pipe, the minimum pipe wall thickness shall be as follows:

Nominal Pipe Size (In.)	Thickness Class
4-12	53
14-18	54
20	55
24	56

10. Pipe for use with sleeve-type couplings shall be as specified except that the ends shall be plain (without bells or beads). The ends shall be cast or machined at right angles to the axis.

B. COUPLINGS AND ADAPTERS FOR DUCTILE IRON PIPE

1. Sleeve-type couplings for plain-end pipe shall be provided with plain rubber gaskets and steel, tee-head bolts with nuts. Couplings shall be given a shop coat compatible with the same outside coating as the pipe specified above. Couplings shall be Dresser style 38 or 138, furnished preassembled, as manufactured by Dresser Industries, Inc., Smith-Blair, Coupling Systems, Inc., or equal.

2. Couplings or adapters as required for connecting existing pipe to new pipe or new pipe to new pipe shall be furnished as required and designed for compatibility with the pipe and operating pressures encountered. Couplings shall be Dresser Style 162 as manufactured by Dresser Industries Inc., or equal. Flanged adapters shall be Dresser Style 128, or equal. Couplings for ductile iron to cast iron pipe shall be Style 53, and for ductile iron to transite pipe shall be style 153, as manufactured by Dresser Industries, Inc., or as manufactured by Smith-Blair, Coupling Systems, Inc. or equal. Transition couplings shall be style 162 as manufactured by Dresser Industries, Inc. or approved equal. Couplings shall be given a shop and field coat of bituminous material compatible with the same outside coating as the pipe specified above.

3. Split couplings may be used for connecting gray cast iron or ductile iron. If split couplings are used with grooved ductile iron pipe, the minimum pipe wall thickness shall be as specified.

Split couplings shall be made of malleable iron and shall be suitable for use with grooved-end or shouldered-end, cast iron pipe. They shall be Victualic couplings made by the Victualic Company of America, Elizabeth, New Jersey; Gruvagrip couplings made by Gustin-Bacon Manufacturing Company, Kansas City, Missouri; Groove couplings made by Eastern Malleable Iron Company, Pittsburgh, Pennsylvania; or equal products.

4. Flexible Couplings: Sleeve-type couplings for plain-end ductile iron pipe shall be provided with plain rubber gaskets and steel, track-head bolts with nuts. Couplings shall be given a shop coat compatible with the same outside coating as the pipe specified above. Couplings shall be furnished pre-assembled by the manufacturer.

5. All couplings shall be furnished with the pipe stop removed.

6. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe. The gaskets shall have metallic tips to provide electrical continuity through the joint.

7. The Contractor shall provide suitable filling rings where the layout of the flanged piping is such as to necessitate their use. In materials, workmanship, facing, and drilling, such rings shall conform to the 125 pound ANSI Standard. Filling rings shall be of suitable length with nonparallel faces and corresponding drilling, if necessary, to endure correct assembly of the adjoining piping or equipment.

8. Couplings for exposed pipe shall be of steel and shall be Dresser Style 38, Smith-Blair Style 411, Baker Allsteel, or equal. The couplings shall be provided with steel bolts and nuts.

9. At the Contractor's option, flexible connections in the piping shall be sleeve-type couplings, split couplings or mechanical joint pipe as herein specified.

C. INSPECTION, TESTS AND ACCEPTANCE FOR DUCTILE IRON PIPE

1. All pipe delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to "AWWA Standard for Ductile Iron Pipe, for Water and Other Liquids" (AWWA H3) and (AWWA C151).

2. All tests shall be made in accordance with the methods prescribed by the above mentioned AWWA Standards, and the acceptance or rejection shall be based on the test results.

3. Pipe which does not conform to the requirements of this contract shall be immediately removed and replaced by the Contractor.

4. All ductile iron pipe to be installed under this Contract may be inspected at the foundry for compliance with these Specifications by an independent testing laboratory selected by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of foundry inspection of all pipe approved for this Contract, plus the cost of the inspection of a reasonable amount of disapproved pipe, will be borne by the Owner.

D. FLANGED JOINTS FOR DUCTILE IRON PIPE

1. For flanged joints, gaskets shall be ring gaskets of rubber with cloth insertion. Gaskets twelve (12)-inches in diameter and smaller shall be 1/16-inch thick, gaskets larger than twelve (12)-inch shall be 3/32-inch thick.

2. Flanged joints shall be made with bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI

Standard as the flanges. Bolts and nuts shall, except as otherwise specified or noted on the Contract Drawings, be Grade B conforming to the ASTM Standard Specification for Carbon Steel, Externally and Internally Threaded Standard Fasteners, Designation A307. Bolts and studs shall be of the same quality as machine bolts. Flanged ductile iron pipe from 3 to 48-inches in diameter shall be classified by Underwriters Laboratories Inc. in accordance with AWWA C115.

2.10 PVC PIPE

A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.

B. PVC (Polyvinyl Chloride) Gravity Sewer Pipe: ASTM D3034, SDR 35, for elastomeric gasket joints. Pipe 18 to 27 inches in diameter shall conform to ASTM F679, T-1 heavy wall.

a. Fittings: Elastomeric joints complying with ASTM D3212 using elastomeric seals complying with ASTM F477.

2.11 CORRUGATED POLYETHYLENE PIPE

A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.

1. Corrugated polyethylene pipe shall have an interior surface that is smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind. Pipe shall conform to AASHTO M-294, AASHTO M252, or AASHTO MP6, Type S depending on the diameter of the pipe required.
2. Pipe and fittings shall be high-density polyethylene meeting the requirements of ASTM D3350.
3. Pipe units shall have a minimum laying length of 20-feet except as otherwise indicated or allowed by the Engineer.
4. Pipe shall be installed with a minimum 12-inch cover for AASHTO H-20 loading.

B. Corrugated Polyethylene Flared End Section:

1. The pipe shall have an interior surface that is smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind. Flared end section shall conform to AASHTO M-294.

C. Joints on Corrugated Polyethylene Pipe.

1. The pipe and fitting joints shall be bell-and spigot with watertight gaskets.
2. Pipe entrances at catch basins shall be made with a mortar made with Type II cement. Mortar mixture shall follow instructions provided by cement manufacturer. Pipe connections at drain manholes and water quality structures shall be made with integral flexible rubber sleeves and Corrugated Pipe Adapters designed for use with the pipe and sleeves.

2.12 CLEANOUTS

A. General: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access

frame and heavy-duty, secured, scoriated cast-iron cover.

2.13 IDENTIFICATION

A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils minimum thickness, with continuously printed caption in black letters "CAUTION - xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer, Storm Sewer
White	Proposed Excavation

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

A. General: General Locations and Arrangements: Contract Drawings indicate the general location and arrangement of the underground storm drainage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical. Any modifications to the layout of the storm drainage system shall be submitted to the Engineer for review and approval at least five days prior to the start of the affected work.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations, accepted practices, and utility owner’s requirements. Maintain swab or drag in line and pull past each joint as it is completed. All pipe shall be laid in the dry.

C. When bell and spigot pipes are used, bell holes shall be dug in the bedding to accommodate the bells. They shall be deep enough to ensure that the bell does not bear on the bottom of the hole but shall be excessively wide in the longitudinal direction of the installation.

D. Use manholes for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into an existing storm drain is indicated.

E. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited without the written approval of the Engineer.

F. Install piping pitched down in direction of flow as indicated on the Contract Drawings.

G. Extend storm drainage system piping to connect to building roof drains, of sizes and in locations indicated on the Contract Drawings.

H. Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

I. Acceptance of Pipe: Acceptance will be on the basis of tests specified herein before. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.

J. Pipe Storage: Pipe sections shall not be stored on areas over the newly laid pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.

K. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.

L. Laying Pipe: Except where a concrete cradle or envelope is required, the pipe shall be laid in a crushed stone cradle. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be "pulled" or "cramped" without approval of the Engineer.

M. Jointing Pipe: After the pipe are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.

N. Alignment and Placement: All pipe shall be laid with extreme care as to grade and alignment. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.

1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.

2. The Contractor shall establish centerline and offset stakes at each manhole, plus one intermediate centerline and offset stake as a check point between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.

O. Cleaning: Care shall be taken to prevent earth, water and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water and debris from entering any existing Drain.

1. Place plugs in end of uncompleted conduit at end of day or whenever work stops.

2. Flush lines between manholes if required to remove collected debris.

P. Review of Completed Storm Drain System: The completed drain system shall be visually inspected by the Owner's Representative. If the visual observation of the completed drain or any part thereof shows any pipe, manhole, or joint to be of defective work or material, the defect shall be replaced or repaired as directed by the Engineer or the Owner's Representative. The Contractor shall coordinate and provide site access for inspection.

3.2 PLACEMENT OF DUCTILE IRON PIPE AND FITTINGS

A. Care shall be taken in loading, transportation, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe and fittings shall be examined before placement, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be

repaired as directed by the Engineer.

B. If any defective pipe is discovered after it has been placed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense. All pipe and fittings shall be kept clean until they are used in the work, be thoroughly cleaned before placement, and when placed, shall conform to the lines and grades required. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. A firm even bearing throughout the length of the pipe shall be constructed by compacting gravel borrow around the pipe and up to the springline.

1. Blocking will not be permitted.

C. All pipes shall be sound and clean before placement. When pipe laying is not in progress, including lunchtime, the open ends of the pipe shall be temporarily closed by watertight plug or other acceptable means. Alignment shall be maintained during placement. The deflection at joints shall not exceed sixty percent of that recommended by the manufacturer. Fittings, in addition to those shown on the plans, shall be provided, if required, in crossing utilities, which may be encountered upon opening the trench. Solid sleeves shall be used only where allowed by the Engineer.

D. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on type bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be inspected for damage and shall be remortared as required to ensure a continuous lining.

E. Concrete thrust blocks shall be installed at all fittings valves and hydrants and other locations as indicated on the Contract Drawings and as directed by the Engineer. Minimum bearing area shall be as shown on the Contract Drawings. Thrust blocks shall bear against undisturbed material, and shall be provided with wooden side forms. In the event that the use of thrust blocks is not practical, the Contractor shall provide an alternate method of joint restraint, at no additional cost, as directed by the Engineer.

F. The Contractor shall take care not to damage pipe by impact, bending, compression, or abrasion during handling, and installation. Joint ends of pipe especially shall be kept clean.

G. Pipe shall be stored above ground at a height no greater than 5 feet and with even support for the pipe barrel.

H. Only nylon-protected slings shall be used for handling the pipe. No hooks, chains or bare cables will be permitted.

I. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors.

J. Jointing of ductile iron push-on pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The last 8-inches of the outside of the spigot end of pipe and the inside of the bell end of pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be painted with a lubricant just prior to making up the joint. The spigot end shall then be gently pushed home into the bell. The position of the gasket shall be checked to ensure that the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.

1. Jointing Ductile Iron Pipe (Push-On Type): Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in

alignment with the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.

2. Jointing Mechanical Joint Fittings: Mechanical joints at valves, fittings, and where designated shall be installed in accordance with the "Notes on Method of Installation" under ANSI Specification A 21.11 and the instructions of the manufacturer. To assemble the joints in the field, the Contractor shall thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torque. Under no condition shall extension wrenches or pipes over handles or ordinary ratchet wrenches be used to secure greater leverage.

K. Installation and jointing of ductile iron pipe shall be in accordance with AWWA C600, Sections 9b and 9c, latest revision, as applicable.

L. Ductile iron pipe installed within 5-feet of gas lines shall be fully encased with polyethylene material. Polyethylene shall be 8-millimeters thick and comply with AWWA C-105.

3.3 PVC PIPE

A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

B. PIPE HANDLING

1. All pipe and fittings shall be carefully handled from the truck onto the ground and into the trench or excavation so as to prevent damage to the pipe. Pipes shall be kept free of dirt and foreign material especially on the inside. Joint ends of pipe shall especially be kept clean.

2. Pipe stored on site shall be protected from heat and direct sun light and shall be suitably ventilated.

3. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.

C. ALIGNMENT AND PLACEMENT OF PVC PIPE

1. Bedding material for the pipe must be installed with care in the area around the pipe. Bedding material must be placed to provide uniform and adequate support under pipe. Do not use blocking to bring pipe up to grade.

2. Provide bell holes at each joint to permit joint to be assembled properly while maintaining uniform pipe support.

3. Place and consolidate the bedding material under the pipe haunch to provide adequate side support while avoiding both vertical and lateral displacement of pipe.

4. Initial backfill must be completed to a point at least 12-inches over the top of the pipe and be hand placed. Use little or no tamping of initial backfill directly over the top of pipe. Compaction methods may be utilized during final backfilling.

5. Jointing of PVC sewer and water pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The bell end of the pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be lubricated prior to making up the joint. The position of the gasket shall be checked to ensure the joint has been

properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.

6. When jointing PVC conduit pipe, it shall be cut square, conduit ends cleaned, an even coating of solvent cement applied to the pipe end and socket, and the conduit firmly pushed together until the conduit bottoms in the socket. The conduit shall be rotated 1/4 turn immediately after bottoming in the socket to ensure even spread of the cement.

7. Detectable warning tape shall also be installed 2-feet below the existing ground surfaces for later use in locating the pipe's exact position.

3.4 INSTALLATION OF CORRUGATED POLYETHYLENE PIPE AND PIPE FITTINGS

A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

B. Acceptance of Pipe: Acceptance will be on the basis of tests specified hereinbefore. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.

C. Pipe Storage: Pipe sections shall not be stored on areas over the newly placed pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.

D. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.

E. Placing Pipe: Except where a concrete cradle or envelope is required, the pipe shall be placed in a crushed stone cradle. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be "pulled" or "cramped" without approval of the Engineer.

F. Jointing Pipe: After the pipe are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.

G. Alignment and Placement: All pipe shall be placed with extreme care as to grade and alignment. Each pipe shall be so placed as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.

1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.

2. The Contractor shall establish centerline and offset stakes at each manhole, plus intermediate centerline and offset stake as needed to ensure proper alignment and grade between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.

H. Cleaning: Care shall be taken to prevent earth, water, and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water, and debris from entering any existing

Drain.

1. Place plugs in end of uncompleted conduit at end of day or whenever work stops.

2. Flush lines between manholes to remove collected debris.

Review of Completed Corrugated Polyethylene Pipe System: If the visual observation of the completed drain or any part thereof shows any pipe, manhole, or joint to be of defective work or material the defect shall be replaced or repaired as directed. The visual observation shall be conducted by the Engineer and any defects shall be as identified by such. The Contractor shall coordinate and provide site access for the Owner.

3.5 INSTALLATION OF DRAIN MANHOLES AND CATCH BASINS

A. The bases shall be supported on a compacted level foundation of gravel borrow at least 12-inches thick.

1. Manhole risers and tops shall be installed using approved butyl-rubber polymer type gasket for sealing joints of manhole risers and tops; jointing shall be performed in accordance with the manufacturer's recommendations. Manhole risers and tops shall be installed level and plumb. Water shall not be permitted to rise over newly made joints, nor until after inspection as to their acceptability. All jointing shall be done in a manner to ensure watertight joints. Openings shall be provided in the precast concrete manhole risers to receive entering pipes and these openings shall be made at the place of manufacture. Connection of pipes to manholes shall be by means of a cement mortar joint.

2. Care shall be taken to ensure that the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Manhole risers and tops shall be installed so that the manhole steps shall be in alignment.

3. All holes used for handling shall be thoroughly plugged with non-shrink grout.

4. Subsequent cutting or tampering in the field, for purpose of creating new openings or altering existing openings, will not be permitted except at the discretion of the Engineer or if necessary concrete block manhole(s) shall be used.

5. Clean all debris, mortar, and soil from the bottom of all structures prior to final acceptance of the project.

3.6 SETTING MANHOLE FRAMES AND COVERS AND CATCH BASIN FRAMES AND GRATINGS

A. Manhole frames shall be set with tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the Contract Drawings or as directed. Frames shall be set concentric with the top of the manhole on a minimum of two courses of brick and in a full bed of mortar so that the space between the top of the brick and mortar and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the concrete shall be placed all around the bottom flange. The mortar shall be smoothly finished to a height of 5-inches above the flange.

1. Only clean bricks shall be used in brick work to adjust frame elevations. The brick shall be moistened by suitable means.

2. Manhole covers shall be left in place in the frame until completion of other work at the manholes.

3. Frame castings for catch basins shall be set on a minimum of two courses of brick and in full mortar beds true to line and grade. Frames shall be set in a grout bed and the cement mortar shall be brought up to a height of not less than 5-inches above the bottom of the frames. Where directed, the castings shall be temporarily set at such grades as to provide drainage during construction. The castings of structures located within the pavement area shall not be completely set to the established grade until the bottom course of pavement has been laid. The final setting of all other casting shall be performed at the proper stage of construction as directed.

3.7 CHANGE IN TYPE

A. When an existing catch basin is to be converted to a manhole, the frame and grate shall be carefully removed and a new frame and cover installed to finish grade. If in the opinion of the Engineer the existing casting is reusable, it may be reused in the work, otherwise, it shall be disposed of off-site.

1. The sump of the catch basin shall be thoroughly cleaned of debris and silt and the interior surfaces brushed to remove contaminants.

2. The sump shall be thoroughly filled with compacted gravel to a level no greater than 6 inches below the pipe invert. A cast-in-place concrete invert shelf and channel shall be poured and shaped to the lower half of the pipes.

3. New openings in existing structures shall be carefully cut with power saws of the proper size and elevation to accept the new connection. Damage to the structure caused by the Contractor's construction methods shall be repaired at no additional cost.

3.8 STRUCTURE REBUILT

A. When in the opinion of the Engineer existing masonry structure walls show deterioration, the structure shall be rebuilt. The casting and deteriorated masonry shall be removed in a careful and neat manner until only a sound condition remains. Concrete blocks shall be used to rebuild the structure. The new masonry construction, replacing of the casting, and other incidental work shall be performed as specified above.

3.9 INSTALLATION OF TANKS

A. If precast tank sections are to be field assembled, adequate waterproofing shall be used at the joint to resist the waterhead at that joint.

B. Structure shall be supported on a compacted level foundation of gravel borrow a minimum of 12 inches thick.

3.10 FIELD TESTING OF CORRUGATED POLYETHYLENE PIPING:

1. The pipe shall be cleaned and visually inspected for offsets and obstructions prior to testing.

2. The total length of each pipe installed on the project shall be tested or inspected for deflection. Conveyance pipes connecting at both ends to concrete drainage structures (catch basins, manholes, outlet control structures, water quality structures, etc.) shall be mandrel tested. Deflection of pipes used for stormwater detention/retention/infiltration systems, and pipes connecting to wye connections, building connections, trench drains, and other connections that do not allow mandrel testing shall be verified by visual inspection by the Owner's Representative during installation.

3. Mandrel tests shall be performed by the Contractor and observed by the Owner's Representative not sooner than 20 days after completion of installation and compaction of backfill. Testing for pipes greater than 24-inch in diameter shall be tested prior to the installation of drainage structure cone and frame.

4. Installed pipe shall be tested to ensure that the maximum deflection of the pipe does not exceed 7.5 percent of its base inside diameter. The base inside diameter is defined as the specified nominal diameter minus the allowable inside diameter tolerance of 1.5% but not more than 1/2 inch.

5. A mandrel shall be pulled through the pipe by hand to ensure that maximum allowable deflections have not been exceeded. The mandrel diameter shall be verified and approved by the Owner's Representative prior to use. Use of an unapproved mandrel will invalidate the test. If the mandrel fails to pass through the pipe, the pipe will be deemed to be over-deflected.

6. The mandrel shall be a rigid device, with an odd number of legs (9 legs minimum) having an effective length not less than its nominal diameter. The mandrel shall be fabricated of steel with pulling rings at each end.

7. The minimum diameters at any point along the full length are as follows:

Nominal Size	Minimum Mandrel Diameter
6"	5.3"
8"	7.0"
10"	8.8"
12"	10.6"
15"	13.2"
18"	15.8"
24"	21.1"
30"	26.4"
36"	31.7"
42"	37.0"
48"	42.2"
54"	47.5"
60"	52.8"

3.11 AREA DRAINS

A. Install area drains per manufacturer specifications.

3.12 CLEANOUTS

A. Install cleanouts and extensions from sewer pipe to grade as indicated on the Contract Drawings. Set cleanout frame and cover in concrete 12 by 12 by 6-inches deep, except where location is in bituminous or concrete paving. Set top of cleanout 1-inch above surrounding earth grade or flush with grade when installed in paving.

3.13 BACKFILLING

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed, all in accordance with local requirements and the contract documents.

B. Initial backfill shall be placed evenly on both sides of the pipe to distribute the load and not to cause movement or deflection of the pipe.

3.14 FINAL INSPECTION

A. Final inspection and acceptance of pipe, valves, appurtenances, hydrants and precast concrete structures shall be made by the Owner's Representative and the utility owner having jurisdiction of the particular system. Prior to placing the systems in service all components shall be inspected, with the Owner's Representative present, to ensure that no debris or other contaminants are present. If necessary, the Contractor shall clean the structures and flush piping.

B. The Contractor is responsible for coordinating and scheduling the inspection of the work by local jurisdictional authorities. No additional payment will be made for inspections and permits required in the performance of the work.

END OF SECTION 33 40 00

SECTION 33 4610

LANDSCAPE SUBDRAINAGE

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK

A Work Included: Execute finish grades complete, as shown on the Drawings, and as specified herein.

B Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. Refer to Section 018110, SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

1.03 RELATED WORK

A The following Related Work to be performed under the designated Sections:

1 Electrical – Section 26 0001
2 Earthwork - Section 31 2000
3 Site Concrete - Section 32 1313
4 Unit Paving – Section 32 1400
5 Miscellaneous Site Improvements - Section 32 3000
6 Fencing - Section 32 3100
7 Irrigation System 32 8100
8 Planting - Section 32 9000
9 Soil Preparation - Section 32 9113

1.04 CONTRACTOR'S IMPLEMENTATION OF THE 1 % MINIMUM PIPE PITCH DESIGN CRITERIA

A The Contractor is to establish the invert elevations from the following design criteria and as shown on the drawings to install the subdrainage system. The intent is to follow the slope of surface finish grades that keep the trench depth constant. Exceptions to this would be where runs are level, or less than 1%, or on lines which have to connect to storm drainage structures, in these cases the depth of the trench and its component parts would increase as necessary to accommodate a minimum of 1% or greater slope.

B Layout: Pipe layout and sizing is shown on the drawings.

C Adjustments:

1 Adjust the Subdrainage System to accommodate any adjustments that may be required. Notify the landscape architect of these conditions before doing adjustments.

1.05 SUBMITTALS

A Submit the following in accordance with the provisions of Section 01 3300 – Submittals.

B Product Data: Manufacturers' current catalog cuts and specifications and/or test results demonstrating compatibility with the specifications for the following: All soil testing reports must be from recent analyses, less than 90 days old, and represent materials that are available for delivery to the site.

1 Drainage Blanket:

a Granular analysis demonstrating compatibility with the specifications from a soils testing lab.

2 Coarse Sand:

a Granular analysis demonstrating compatibility with the specifications from a soils testing lab.

3 Rigid Pipe: Solid and perforated PVC drain pipes and fittings.

4 Flexible Pipe: Perforated and solid flexible pipe and fittings.

5 Filter Fabric.

C Samples:

1 Filter Fabric - (12) inch x (12) inch.

2 AdvanEdge Pipe – 12 inch section

D Landscape Subdrainage Systems Testing

1 Testing for Obstructions and Debris of the Installed Landscape Subdrainage System.

a Before trench backfilling and final connections are completed to the drainage lines installed in Section 02720 Storm Drains, test with adequate flowing water and where possible visual observation to confirm that there is no debris or obstructions, bad connections or any other fault in landscape subdrainage as follows:

1) For each subdrainage line, test all cleanouts one at a time in incremental from the furthermost one from the connection point to the closest one from the connection point to the Storm Drainage System Connection Point(s).

2) Written Drainage Testing Certification

a) The Contractor shall provide written certification that drainage flows unobstructed from each cleanout.

b Any part of the Landscape Sub Drainage system which fails this testing for any reason shall have the problem corrected by the Contractor and that portion retested until it passes at no additional expense to the Owner.

2 Testing and Flushing of the Subdrainage System After the Sport Field Soil Topsoil has been Installed.

a Flush the Subdrainage System with adequate flowing water and where possible visual observation to confirm that there is no debris or obstructions, bad connections or any other fault in subdrainage as follows:

1) For each subdrainage line, test all cleanouts one at a time in incremental from the furthermost one from the connection point to the closest one from the connection point to the Storm Drainage System Connection Point(s).

E Record Drawings (Plans and details): Refer to Division 1 General Requirements, Closeout Procedures for additional Record Document requirements.

1 Locate such items as but not limited to the following items:

a Connection to existing drainage lines.

b Solid PVC pipe sizes, locations and invert elevations.

c Perforated Pipe sizes, locations and invert elevations.

d Cleanout locations.

e Sleeves.

f All other miscellaneous components.

2 Deliver 1 reproducible Record Drawings to the Landscape Architect within seven (7) working days before the date of Final Inspection. Delivery of the record drawings shall not relieve the Contractor of the responsibility of furnishing required information in the future.

1.06 PROJECT/SITE CONDITIONS

A Protection of Utilities:

1 Provide temporary support and protection of underground and surface utility structures, drains, services and other improvements to remain.

2 Where grade or alignment of pipe is obstructed by existing utility structures such as conduits, ducts or pipes, notify the Landscape Architect in writing and provide a recommendation to reroute the underdrain line meeting all other drawing and specification requirements for his approval.

3 Restore all damaged improvements to original condition at no additional cost.

1.07 DELIVERY, STORAGE, AND HANDLING

A Delivery: All containerized products shall be delivered to the site in manufacturer's original, unopened, legibly labeled containers. All pipe to be delivered bound securely to prevent damage. Supply pallets as required to protect products.

B Storage: Protect materials from damage, water and rust. Store pipes on beds that are full length of pipe. (Protect plastic materials from direct sunlight.)

C Pipe: Cap openings to prevent entry of dust, debris and other foreign matter.

1.08 SEQUENCING AND SCHEDULING

A Concealed Work: Prior to and work in this Section Verify in the field the locations and invert elevations of all drainage structures to receive landscape subdrainage connections.

1 Refer to Item 3.01B of this Section for additional requirements.

2 Refer to Civil Engineering Drawings for storm drainage structures/basins.

B Lines and Levels: Establish for each drainage system and coordinate with other systems to prevent conflicts and maintain proper clearances.

C The following sequencing and scheduling for the sport fields is general only and does not list all the items of work:

Rough grading and amending free draining subsoil
Install drainage blanket components
Install and amend sport field topsoil
Finish grading
Install lawn

1.09 DEFINITIONS

A References to Landscape Architect shall mean Architect or the Architect's designated representative.

PART 2 - PRODUCTS

2.01 DRAINAGE BLANKET - SAND

A Sand for drainage blanket beneath sportsfields shall be uniformly graded coarse sand consisting of clean, inert, rounded grains of quartz or other durable rock and free from loam or clay, surface coatings, mica, other deleterious materials with the following gradation.

U.S. Sieve Size Number	Percent Passing Minimum	Maximum
10	100	-
18	65	90
35	35	70
60	15	30
140	0	8
270	0	3
0.002mm	0	0.5

B Maximum size shall be one inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.

C The ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 2.8 or less. (D70/D20 <2.8)

2.02 MANUFACTURED UNITS

A RIGID PIPE: Solid And Perforated PVC Drain Pipe And Fittings

1 PVC drain and fittings shall conform to ASTM D-30343 or ASTM F679 (SDR 35 minimum). Polymer compounding and classification shall be in accordance with ASTM D-1784, (Class 12454-B).

2 All fittings shall be injected molded. Fabricated fittings are not allowed except as permitted by the Landscape Architect.

3 Joint for PVC pipe shall be oil resistant compression ring of elastomeric material conforming to ASTM D-3212, push on bell and spigot pressure type joints.

4 Solid PVC pipe and fittings and components shall be by a manufacturer who meets the specifications for these items as specified herein.

5 Pipes shall be sized to meet the requirements as shown on the Drawings.

B FLEXIBLE PIPE: - Solid And Perforated Pipe And Fittings

1 Flexible pipe and fittings shall be by ADS / Advanced Drainage Systems, Inc., Palmer MA. Tel. 800 821 6710 and 413-283-9797, or equal.

2 ADS Gasketed PVC adaptor fitting to connect flexible ADS piping to rigid PVC piping.

a ADS – Gasketed PVC Pipe Fitting # N – 12 Adaptor with SDR 35 Spigot, size 6 inch.

3 End Caps

a End Caps (solid) shall be # N– 12 solid ADS gasketed end caps, size 4 inch.

4 Flexible ADS Pipes shall be 6 inch.

C Flat Pipe: 12" AdvanEdge Flat Pipe and Accessories as Manufactured by Advanced Drainage Systems, Inc., 1-800-733-9554.

1 12" Flat Pipe: Flat Pipe and Filter Fabric.

2 12" Side Out: #1471 AA.

3 12" End Out: #1472 AA.

4 12" Endcap: #1432 AA.

5 12" Wye: #1480 AA.

6 12" Tee: 1460 AA.

D Filter Fabric

1 Mirafi # 140.

PART 3 - EXECUTION

3.01 EXAMINATION

A Verification of Conditions: Verify exact locations all storm drainage structures and drain lines prior to beginning of work. Identify required layout lines, finish grading, subgrading, contours, and datum. Immediately report to Landscape Architect all discrepancies found prior to installation of Subdrainage System.

B Establish the connection outfall locations, grades and depths to accommodate the minimum 1% pitch (unless shown otherwise on the drawings) required for all subdrainage piping.

1 Concealed Work Storm Drainage Structure's: Prior to and work in this Section Verify in the field the locations and invert elevations of all drainage structures to receive landscape subdrainage connections.

2 Verify before any excavation that all subdrainage lines will have a minimum of 1% pitch to the storm drainage structure unless noted on the drawings.

a Notify the Landscape Architect immediately if the minimum 1% pitch is not achievable.

C Refer to the Site Grading Plans and Details, Subdrainage Plans and Details and the Planting Plans and Details for the location and installation of the Site Drainage System and as specified herein.

3.02 INSTALLATION OF SUBDRAINAGE

A The Subdrainage System shall be the Subdrainage installed as shown on the Drawings and Details and as specified herein.

1 Verify the Site Conditions to date and accommodate any changes that could affect the Subdrainage system.

2 Locate all the storm drainage structures/basins for storm drainage pipe stub in locations and verify in the field the correct elevations in these structures as provided under the Civil Engineering Drawings.

a Core drill into the storm drainage structures and install a 6 inch solid PVC pipe into the drainage structure so 6 inches of the pipe penetrates out of the inside wall of the structure and 2 - feet beyond the outside wall of the structure unless otherwise required by the Civil Engineer.

b Provide mortar as required by the Civil Engineer that will provide a secure acceptable pipe connection into the storm drainage structure. This work shall be done at no additional cost to the Owner.

3 Install the ADS and Flat Drain gasketed PVC adaptor fittings to connect the solid PVC pipe to the flexible ADS Perforated Pipe.

4 Subdrainage Conditions and installation refer to the Drawings and the Details and as specified herein:

a Drainage Blanket Drains:

1) Refer to the Drawings and Details.

b Cutoff Drains:

1) Refer to the Drawings and Details.

c Install all other items required to install the system as shown on the Drawings or as specified herein.

3.03 INSTALLATION OF DRAINAGE BLANKET

A Install the Drainage Blanket as shown on the Drawings and Details and as specified herein.

3.04 MAINTENANCE AND PROTECTION

A General: Keep clean and protect subdrainage system until Acceptance of the work.
1 Sediments: Regularly inspect and clean all landscape drainage lines and pavement drains to prevent flooding. Sweep, hand, machine, or hose clean all drainage as necessary to maintain proper Landscape Drainage.

2 Subdrainage: Monitor sub-drainage systems and immediately identify all problems with drainage. Make adjustments and clean out as necessary to maintain proper functioning sub-drainage.

END OF SECTION