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SECTION 02 41 13 – SITE PREPARATION

PART 1 - GENERAL

1.1 REFERENCE

A. The conditions and general requirements of the Contract, Division 0 and applicable parts of Division 1, apply to the work under this Section.

1.2 SECTION INCLUDES

A. Protection of existing paving, lighting, and utilities to remain within and adjacent to the property.
B. Disposal of all debris legally off site.
C. Erosion control.
D. Construction fencing.
E. Saw cutting existing pavement.

1.3 RELATED WORK

A. Section 01 57 13 – TEMPORARY EROSION AND SEDIMENTATION CONTROLS.
B. Section 31 00 00 – EARTHWORK.

1.4 SUBMITTALS

A. The Contractor shall, prior to any removal of rubbish or debris from the site, submit written evidence satisfactory to the Owner's Representative that he has an approved dumping location for debris and/or spoil from his demolition and excavation activities.

B. Prior to beginning the work of this Contract, the Contractor shall submit a plan indicating stockpile areas and equipment and materials storage areas to the Owner's Representative for review and approval. The Contractor shall provide any security measures necessary to protect his work and equipment at no additional costs to the Owner.

1.5 EXAMINATION OF SITE AND DOCUMENTS

A. By submitting a bid the Contractor affirms that he has carefully examined the project documents site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

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, as no additional compensation will be made for errors or inaccuracies that may be found therein.

1.6 LAWS AND ORDINANCES

A. Follow all Local, State and Federal laws and ordinances which apply to the work of this Section.

1.7 REFERENCES

A. MassDOT: "Standard Specifications for Highways and Bridges", Massachusetts Department of Transportation, latest edition.

B. Work operations shall meet American National Standards Institute [ANSI] Standard Z-133.1.

1.8 PUBLIC SAFETY

A. The Contractor shall be solely responsible for pedestrian and vehicular safety and control within the work site. Provide all necessary signage as required by the jurisdictions having authority for rerouting of pedestrian traffic during construction operations.

B. All equipment to be used and all work to be performed shall be in full compliance with all OSHA standards including, but not limited to, those regulations concerning noise levels, protective devices and operator safety. Immediately discontinue any obviously hazardous practice.

C. Contractor shall coordinate for any police details required by the City as a result of the work related to this project. Adhere to all applicable timeframes and requirements of the responsible agency/agencies.

1.9 DIG SAFE

A. Contractor is required to contact Dig Safe, tel: 811, a minimum of 3 business days, or 72 hours, prior to start of construction.

B. Contractor will be given a Dig Safe ticket number as proof of notification. Provide Owner's Representative with number.

1.10 SPECIAL PROTECTION FOR MAINTAINING STREETS AND PUBLIC WAYS

A. Do not close or obstruct streets or sidewalks within the public right of way without a permit. Do not place or store material in streets or sidewalks.

B. Conduct operations with minimum interference to the abutting streets.

1.11 SITE STORAGE AND LAYDOWN AREA

A. Contractor shall be allowed to store equipment and materials within the project limits or as approved by Owner. Contractor is responsible for any and all damage to the storage area during their use. Contractor shall furnish and supply construction fencing and gates for proper securing of equipment and materials. Contractor is solely responsible for securing equipment and materials contained therein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. CONSTRUCTION FENCE: Erect a 6' high galvanized chain link construction fence along the lines shown on the Drawings with gate locations to be determined in the field. Erect the fence immediately after receiving the Notice to Proceed and maintain the fence in a secure and sightly condition until instructed by the Owner's Representative to remove it or portions thereof. Secondhand fencing materials meeting the requirements specified herein and in good condition may be used to provide the necessary barrier during construction on this project. Equivalent tubular sections, H-sections or roll formed sections may be substituted for pipe sections if acceptable to the Owner's Representative. Gate location shall be approved by the Owner's Representative.

B. TREE PROTECTION FENCING: 6' chain link fence and posts as approved by Owner's Representative. Secondhand fencing materials meeting the requirements specified herein and

in good condition may be used to provide the necessary barrier during construction on this project.

2.2 EROSION CONTROL

A. See Section 01 57 13 – TEMPORARY EROSION AND SEDIMENTATION CONTROLS.

PART 3 – EXECUTION

3.1 STAKING OUT PROJECT COMPONENTS

A. All lines and grades not presently established at the site shall be laid out by the Contractor in accordance with the Drawings. Maintain all established bounds and benchmarks and replace as directed any which are destroyed or disturbed.

3.2 SITE CLEARING - GENERAL

A. General: Remove trees, shrubs, lawn, improvements, or obstructions, except for those indicated on the Contract Drawings to remain, interfering with installation of new construction. Remove such items elsewhere on site or premises as specifically indicated.

B. In all areas that are to be cleared, all brush, grass and other vegetation, except trees, shall be cut off flush with or below the original ground surface.

3.3 STRIP EXISTING LAWN

A. The Contractor shall remove existing lawn turf in proposed areas of regrading and reseeding.

B. The work shall consist of stripping by mechanical rake or by hand the existing turf vegetation present on all grassed areas within the job site as directed by the Owner. The stripping shall remove turf vegetation only. The Contractor will be responsible for disposal of all stripped material in an off-site location provided by the Contractor.

3.3 CONSTRUCTION AND TREE PROTECTION FENCING

A. Construction and tree protection fencing shall be installed in accordance with the Drawings and in methods indicated in the approved shop drawings. Contractor shall review construction and tree protection fence daily and remedy any damage, unsecured, or dislodged fencing immediately.

3.4 SAFETY

A. All tree removal equipment to be used and all work to be performed must be in full compliance with all standards as promulgated by OSHA at the time of bidding, including, but not limited to those regulations concerning noise levels, protective devices and operator safety.

B. The Contractor shall be solely responsible for pedestrian and vehicular safety and control within the work site and shall protect the public and its property from injury or damage that could be caused by the progress of the work. To this end the Contractor shall post all work areas. The Contractor must also provide police details and / or erect and maintain protective devices acceptable to the City Arborist, including but not limited to barricades, lights and warning signs.

C. Any practice employed by the Contractor that is obviously hazardous, as determined by the City Arborist, shall be immediately discontinued.

3.5 SALVAGE

A. Miscellaneous items including signs, utility covers, flagpole, etc. shall be carefully stored in a secure location for the duration of the project, including periods of inactivity. Existing concrete footings shall be removed from post bases prior to re-installation.

B. Owner shall have the first right of refusal for all items discovered above or below grade on site during the process of the work. Contractor shall verify with the Owner as to whether the objects are desired to be returned to the Owner or whether disposal is desired.

3.6 REMOVALS AND DISPOSAL OF MATERIALS

A. Within the construction area, remove all existing obstructions such pavements, footings, and the like, which are to be abandoned to at least 1 foot below final finish grades and to greater depths as required by new construction.

1. The use of explosives will not be permitted.
2. At the Owner's discretion, certain obstructions may not be removed to full depth if removal, in the Owner's opinion, will negatively affect materials to remain.
3. Removal of concrete pavement includes the removal of any wire mesh and rebar reinforcing.
4. Miscellaneous soils and granular base materials not appropriate for reuse shall also be removed.

B. Materials indicated on the Contract Documents or designated by the Owner in the field to be removed shall be dismantled, removed, and legally disposed of off-site as indicated on the Contract Documents and as specified and performed in this Division 2 Section, SITE PREPARATION.

C. The Contractor shall be responsible for the methods used in this work including properly protecting against damage to all site improvements, utility lines, trees, etc. Check with the municipality and local utility companies for locations of all existing utilities which may be in use or abandoned. Investigate and ascertain that underground utilities are correctly located and that they have been shut off and/or abandoned before disturbing them.

D. Legally dispose of all demolished material not to be reused and rubbish off the site. Provide Owner with written affidavits confirming legal disposal. On site burning will not be allowed.

3.7 SAWCUTTING PAVEMENT

A. Sawcut all existing concrete paving with an approved diamond blade concrete saw on a neat, straight line to the dimensions given, or directed. Remove the portion behind the cut with proper tools, keeping noise and disturbance to a minimum.

1. All sawn edges of paving shall be protected from damage until new paving is placed against it. Existing pavement which is damaged, disturbed or settled, shall be cut back by the same method and replaced as directed by the Owner’s Representative at no additional cost to the Owner. This Item shall include the removal of all layers of pavement and of gravel or other base or sub-base materials as required beneath pavements removed.

END OF SECTION
02 41 13

SECTION 26.00.00
ELECTRICAL

PART 1 – GENERAL

1.01 DESCRIPTION

A. This section specifies requirements for electrical construction. The Electrical Contractor shall furnish, install the materials, and components required to complete all Work related to this Section.

B. All of the Contract Documents, including General and Supplementary conditions and Division 0 – Bidding Documents, Contract Forms and Conditions of the Contract and Division 1 – General Requirements, apply to the work in this Section.

C. Carefully examine all the Contract Documents for requirements which affect the work of this Section. The exact scope of this Section cannot be determined without a thorough review of all specifications sections and other Contract Documents.

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.

1.02 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.

E. Refer to alternates section and allowance section for items affecting electrical.

1.03 SCOPE

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

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. Secondary distribution equipment and panelboards including feeders and sub-feeders.
2. Lighting systems, exterior, including fixtures, lamps, time clocks, and lighting controls.
3. All raceway systems, including boxes, couplings, and fittings.
4. All branch circuit wiring systems, including wiring devices, plates.
5. Excavation and backfill for any underground raceways.
6. Drilling, coring, and cutting of holes and openings
7. Scaffolding, rigging, and staging required for all electrical work.
8. Fire stopping shall be performed by the electrical contractor.
9. Provide seismic restraints for all electrical systems and conform to Massachusetts State Building Code.
10. Prepare and submit a work order to the local utility for the new electrical service
11. Phasing and demolition.
12. Any other item of work hereinafter specified or indicated on electrical drawings.

1.04 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. Furnish: Purchase and deliver to a specific location within the building or site.
2. Install: With respect to equipment furnished by others, install means to receive, unpack, move into position, mount, and connect including removal of packaging materials.

3. Conduit: Raceways of the metallic type, which are not flexible. Specific types as specified.
4. Connect: To wire up, including all branch circuitry, control and disconnection devices so item is complete and ready for operation.
5. 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.
6. Wherever the terms "shown on drawings" are used in the specifications, they shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.
7. Wherever the term "provide" is used in the specifications it will mean "furnish" and "install", "connect", "apply", "erect", "construct", or similar terms, unless otherwise indicated in the specifications.
8. Wherever the term "material" is used in the specifications it will mean any "product", "equipment", "device", "assembly", or "item" required under the Contract, as indicated by trade or brand name, manufacturer's name, standard specification reference or other description.
9. The terms "approved", or "approval" shall mean the written approval of the Architect.
10. The term "specification" shall mean all information contained in the bound or unbound volume, including all "Contract Documents" defined therein, except for the drawings.
11. The terms "directed", "required", "permitted", "ordered", "designated", "prescribed", and similar words shall mean the direction, requirement, permission, order, designation or prescription of the Architect; the terms "approved", "acceptable", "satisfactory", and similar words shall mean approved by, acceptable or satisfactory to the Architect; and, the terms "necessary", "responsible", "proper", "correct", and similar words shall mean necessary, reasonable, proper or correct in the judgment of the Architect.
12. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction or in crawl spaces.
13. "Exposed" means not installed underground or "concealed" as defined above.
14. "The Subcontractor" shall refer to the "Electrical Subcontractor" responsible for all work under the Electrical Section of these specifications, as applicable and as defined under Supplementary General Conditions and other Sections of these specifications. It is the intent of these specifications that the Electrical Subcontractor and his Sub-Subcontractors shall be responsible for furnishing and installation of all work indicated on the Electrical Contract Drawings and Specifications, and all related or implied work specified in other Sections of these specifications, as such information and requirements relate to the Electrical Trade.

1.05 RELATED WORK

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

1. Excavation and Backfill: SECTION 31.00.00, EARTH WORK
2. Concrete Bases, Pads, and Duct Envelopes: DIVISION 03.30.00, CONCRETE.
3. CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: SECTION 01 74 19
4. Patching: To be done by trade responsible for surface requiring patching.

1.06 CONTRACT COST BREAKDOWN

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

1.07 INSPECTION OF SITE

A. It is optional, for the Electrical bidders 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 specifications and the drawings and under all site conditions, as they exist.

1.08 CONTRACTOR'S REPRESENTATIVE

A. Retain a competent representative on the project.

1.09 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.

B. Before proceeding, examine all construction drawings and consult other contractors to coordinate installation and avoid interference.

C. In case of dispute, the Architect will render a decision in accordance with General and Supplementary General Conditions.

1.10 CODES, ORDINANCES, AND PERMITS

A. Codes and Ordinances

1. All material and work provided shall be in accordance with the following codes and standards as most recently amended.

NFPA -70 "*National Electrical Code*", 2026 Edition
Massachusetts Electric Code Amendments, 2026 Edition
Commonwealth of Massachusetts State Building Code, 10th Edition
International Building Code (IBC), 2021 Edition
State Department of Public Safety
Standards of the Underwriters Laboratories (UL)
Occupational Safety and Health Act (OSHA)
Americans with Disabilities Act (ADA)
Energy Conservation Code
International Energy Conservation Code (IECC), 2021 Edition
City of Worcester

B. Permits: Be responsible for filing documents, payment of fees, and securing of inspection and approvals.

1.11 ELECTRICAL ROOMS OR SPACES

A. Be responsible for ensuring that the dedicated space and clearances required in the NEC, Article 110.26 is maintained for all electrical equipment.

B. Call other contractors' attention to the requirements contained in the above mentioned code sections, prior to the installation of equipment by other contractors, in order to ensure no violations.

1.12 SUBMITTALS

A. Refer to Supplementary General Conditions for information relative to submission of shop drawings. No equipment for which review is required shall be installed prior to review, except at Contractor's own risk. Shop Drawings will be required for all electrical equipment.

B. Notwithstanding any restrictions upon contractor proposed substitutions, should apparatus or materials be permitted by Architect to be substituted for those specified for good cause, and such substitution necessitates changes in or additional connections, piping, supports, or construction, same shall be provided. Assume cost and entire responsibility thereof.

C. Submit the following samples:

1. Lighting fixtures other than specified item.
2. Other items as may be requested.

1.13 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.

1.14 RECORD DRAWINGS

A. Refer and comply with SECTION 01.77.00, PROJECT CLOSEOUT and the following;

B. 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. Record drawings shall be updated at least monthly. Record drawings shall show outlet from which homeruns are taken, and location of all junction boxes and access panels. These drawings shall be available to Architect/Engineer field representative.

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

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

E. After approval of these drawings, photo reproductions of original tracings shall be revised to incorporate changes, including addenda sketches and supplementary drawings. Fit-up drawings for tenant areas shall also be revised in the same manner. These “as-built” photo reproductions shall be certified as correct and delivered to the Architect along with two (2) sets of black line prints. Sepia reproducibles are not acceptable.

1.15 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

A. Refer to and comply with SECTION 01.77.00, PROJECT CLOSEOUT and the following:

B. Operating Instructions: Furnish operating instructions to Owner's designated representative with respect to operations, functions, and maintenance procedures

for equipment and systems installed. Cost of such instruction up to a full three (3) days of Electrical Subcontractor's time shall be included in contract. Cost of providing a manufacturer's representative at site for instructional purposes shall also be included.

C. Maintenance Manuals

1. Provide four copies of complete manuals containing the following:

a. Complete shop drawings of equipment.
b. Operation description of systems.
c. Names, addresses, and telephone numbers of suppliers of systems.
d. Vendors' P.O. numbers for equipment installed.
e. Preventive maintenance instructions for systems.
f. Spare parts list of system components.

2. All information shall be in binders.

1.16 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 at all terminations.

1.17 ALTERNATES

A. Include separate pricing for amounts to be added to or deducted from base bid amount for the following areas of electrical work.

PART 2 - PRODUCTS

2.01 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. For purpose of establishing a standard of quality and not for purpose of limiting competition, the basis of this Specification is upon specified models and types of equipment and materials, as manufactured by specified manufacturers.

C. In all cases, standard cataloged materials and systems have been selected. Materials such as lighting fixtures specially manufactured for this particular project and not part of a manufacturers' standard product line will not be acceptable. In the case of systems, the system components shall be from a single source regularly engaged in supplying such systems. A proposed system made up of a collection of various manufacturers' products will be unacceptable.

D. Where Specifications list manufacturers' names and/or "as approved" or "Equal approved by Architect", other manufacturers' equipment will be considered if equipment meets Specification requirements and has all features of the specified items as are considered essential by Architect.

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

2.02 RACEWAYS AND FITTINGS

A. Raceways - General

1. No raceway shall be used smaller than 1/2" diameter and shall have no more than four (4) 90° bends in any one run, and where necessary, pull boxes shall be provided. Only rigid metal conduit or intermediate metal conduit is allowed for 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 conforming to, and installed in accordance with, Article 344 shall be heavy wall zinc coated steel conforming to American Standard Specification C80 1 and may be used for service work, exterior work, slab work, and below grade level slab, wet locations, where raceway may be subject to mechanical damage.

a. Design and Performance Requirements

1) Condulet Bodies shall be dust-tight. Certified to UL50E
2) Condulet Bodies shall be NEMA 3R raintight when installed with a cover and gasket.
3) Conduit bodies when Iron made shall be protected with a three coat finish consisting of cadium, zinc and aluminum acrylic paint
4) Conduit bodies shall have a rounded bottom that helps prevent the snagging of fish wire
5) Conduit bodies when Iron made shall be able to be removed from an installation by cracking with a hammer
6) Condulet Bodies shall be approved for Class I, Division 2 when installed in compliance with NEC 501.10(B)(4)
7) Condulet Bodies shall be approved for Class II, Division 1 when installed in accordance with NEC 502.10(A)(3)
8) Condulet Bodies shall be approved for Class II, Division 2 when installed in accordance with NEC 502.10(B)(4)

3. Intermediate Metal Conduit (IMC) conforming to, and installed in accordance with, Article 342, may be used for all applications where rigid metal conduit is allowed by these specifications.
4. Electrical Metallic Tubing (EMT), conforming to, and installed in accordance with, Article 358 shall be zinc coated steel, conforming to industry standards, 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.
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 contractor's option for underground electric and low tension services outside the foundation wall and shall be Polyvinyl Chloride (PVC) schedule 40, 90ºC.
7. Rigid non-metallic conduits shall be polyvinyl chloride (PVC) schedule 80, 90°C (thick wall) conforming to and installed in accordance with ARTICLE 352.
8. Acceptable manufacturers:

Robroy Industries
Republic Conduit
Youngstown Tube Company

Carlon
Allied Tube and Conduit

9. Fittings

a. Provide insulated bushings on all raceways 1-inch diameter or larger.
b. Manufacturer's standard fittings shall be used for raceway supports.
c. Expansion Fittings: Expansion fittings shall be used where structural and concrete expansion joints occur and shall include a ground strap.
d. PVC expansion fittings shall be used where it is expected to be more than a ¼" or greater in a straight run between securely mounted items such as boxes, cabinets, elbows or other conduit termination. Comply with table 352.44 for expansion characteristics for PVC conduits.
e. Couplings for rigid metal and intermediate metal conduit shall be threaded type.
f. Threadless fittings for EMT shall be watertight compression type (wet locations) or set screw type (dry locations). All fittings shall be concrete tight. No diecast fittings allowed except for raceways larger than 1-inch diameter.
g. Cable supports in vertical raceways shall be of the split wedge type. Armored cable supports for vertical runs to be of wire mesh basket design.
h. Wall entrance seals shall be equal to O.Z. Gedney type "WSK".
i. Couplings, elbows and other fittings used with rigid nonmetallic conduit shall be of the solvent cemented type to secure a waterproof installation.
j. Acceptable manufacturers:
O.Z.
Crouse Hinds
Appleton
EFCOR
Steel City

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. Each box shall have sufficient volume to accommodate number of conductors in accordance with requirements of Code. Boxes shall not be less than 1 1/2" deep unless shallower boxes are required by structural conditions and are specifically approved by Architect. Ceiling and bracket outlet boxes shall not be less than 4" octagonal except that smaller boxes may be used where required by particular fixture to be installed. Flush or recessed fixtures shall be provided with separate junction boxes when required by fixture terminal temperature requirements. Switch and receptacle boxes shall be 4" square or of comparable volume.

c. Far side box supports shall be Caddy J 1A.

d. Acceptable manufacturers:
Appleton
Crouse Hinds
Steel City
RACO

2. Pull and Junction Boxes

a. 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.

b. Boxes in moist or wet areas shall be galvanized type. Boxes larger than 4 11/16 inches square shall have hinged covers. Boxes larger than 12 inches in one dimension will be allowed to have screw fastened covers, if a hinged cover would not be capable of being opened a full 90 degrees due to installation location.

c. Acceptable Manufacturers:

Hoffman
Keystone
Lee Products Co.

2.03 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', #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.	Grounded Conductor	120/208	White
5.	Equipment Ground	120/208	Green

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

B. 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
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.

C. 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°C) except as follows:

   a. In sizes #1 AWG and larger: Crosslinked polyethylene insulation type XHHW (75°C, 90°C) may be used.

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

2.04 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 un-sleeved openings shall be waterproofed.

A. Inserts: Provide inserts or other anchoring devices in concrete and masonry construction as required to support raceways and equipment.

B. Openings: Where an opening is required in concrete slabs to allow passage of a multitude of raceways, give adequate notice to General Contractor so he may box out opening in form work.

C. Sleeves or openings through slabs for passage of future cables shall be located within 6 inches of walls and shall be in a single row and shall be proofed whether used or not.

D. Any openings through fire rated surfaces shall be closed off with fireproofing materials providing the same rating as the surface penetrated.

E. Acceptable Manufacturers:

Specified Technologies Inc.
Thomas & Betts
3M Fire Protection Products
Dow Corning

2.05 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 Centium in single, two, three and four lamp versions and input current total harmonic Distortion not exceeding 10%. Compact fluorescent electronic ballasts shall sense end of life conditions.

C. All specialized lamps to be of a type recommended by the fixture manufacturers in their photometric reports.

D. Exterior LED sources shall meet the following requirements:
1. Operating temperature rating shall be between -40°F [-40°C] and 120°F [50°C].
1. Color Rendering Index (CRI): ≥65.
2. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High

Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).

E. Fixture types shall be as scheduled. The note on fixture schedule "Possibly Acceptable Alternate Manufacturers" means that the manufacturers listed have products which could be equal. The determination of "equal" will be determined based upon features of the product specified by catalog number. A sample of any proposed substitution will be required. Standard cataloged products have been selected. Fixtures specially manufactured for this particular project and not part of a manufacturer's standard line will not be acceptable.

F. All light fixtures are to meet the IBC, Energy Code for that area by using COMcheck program. A program created by the United States Department of Energy. All substituted fixtures are to be approved by the engineer and must have the wattage for each fixture in order for it to be reviewed. All submittals relating to the lighting shall be rejected, until this COMcheck is reviewed by the Engineer of Record (EOR).

2.06 GROUNDING SYSTEM

A. All equipment and systems shall be grounded. Refer especially to NEC Article 250.52 Requiring Connections to Building Steel, Foundation, Water Service, and Interior Piping. Provide transformer pad grounding to be in accordance with utility company standards.

B. The grounded conductor shall be supplemented by an equipment grounding system.

C. The equipment grounding system shall be installed so all conductive items in close proximity to electrical circuits operate continuously at ground potential and provide a low impedance path for ground fault currents.

D. Grounding conductors shall be so installed as to permit shortest and most direct path to ground.

E. Equipment grounding conductors and straps shall be sized in compliance with Code Table 250.122.

F. Grounding conductors shall be insulated with green color. Grounding conductors for use on isolated ground receptacles shall be green with trace color to differentiate between normal ground conductors.

G. Branch circuits shall consist of phase and grounded conductor installed in common metallic raceway. The raceway system may not serve as the grounding conductor. All circuits shall have a separate insulated grounding conductor installed. Any flexible cable system or non-metallic raceway system shall have an insulated grounding conductor. Any cable system for use on isolated ground circuits shall have both an isolated ground conductor as well as an equipment ground conductor, both of which shall be insulated.

H. Each electrical expansion fitting shall be furnished with a bonding jumper. Provide grounding bushings and ground connections for all raceways terminating below equipment where there is no metal to metal continuity.

I. Continuity between all metallic and non-metallic raceway systems and equipment shall be maintained.

J. Outdoor lighting fixtures shall be grounded and bonded in common with building system via a separate grounding conductor.

K. Grounding Equipment

1. Ground Rods

a. Copper clad steel/, 19 mm (0.75 inch) diameter by 3 M (10 feet) long.
b. Quantity of rods shall be as shown on the drawings, and as required to obtain the specified ground resistance.

2. Ground Connections

a. Above Grade:

1) Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
2) Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with //zinc-plated//cadmium-plated// steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.07 LOAD CENTERS

A. Manufacturers

1. The loadcenters shall be a PL or ES Series Load Center manufactured by Siemens or pre-approved equal. Approved manufacturers are as follows:

    a. Siemens
    b. Murray
    c. Square D
    d. Cutler Hammer

B. RELATED STANDARDS

1. The loadcenters shall comply with UL 67 and shall be UL Listed and shall comply with the requirements of the National Electrical Code. Panelboard enclosures shall comply with NEMA 250.
2. Circuit protection devices shall be UL Listed and shall comply with the following standards:
3. UL 489, Molded Case Circuit Breakers
4. UL 489 and 943, Ground Fault Circuit Interrupters
5. UL 489 and 1699, Arc Fault Circuit Interrupters
6. Loadcenters shall comply with the requirements of Federal Specification W-P-115B, Panel Power Distribution

C. Enclosures

1. Loadcenters shall have a NEMA 3R with G90 galvanized steel enclosure. Mounting as noted on the drawings
2. The knockouts shall be pre-stamped into the enclosure.
3. The trims shall have mounting tabs so that the cover can be hung in place freeing both hands to install the hardware.
4. The width shall be 14-3/8" wide to fit between standard wall studs.

D. Interior

1. The interior shall be convertible from main breaker to main lug and vice-versa. The main shall be designed for straight in wiring. Bending the cable 90 degrees is not required.
2. The neutral bar shall be visible to simplify the insertion of neutral conductors.
3. The screws shall be installed in the neutral, bond and ground bars, yet backed out so that the installer can quickly land neutral and ground wire.
4. The screws for the neutral, ground, breaker, trim and pan adjustment shall have a combination head to fit a square and a flathead slot.

5. The circuit numbers shall be stamped on the dead front.

E. Breakers

1. The loadcenter main circuit breakers as indicated on the drawings.
2. The loadcenter with main lugs, as indicated on the drawings.
3. Indoor loadcenters shall be 180 degree invertible.
4. The breakers shall be fully rated and shall be plug-in type. The breakers shall be molded case and thermal-magnetic rated as noted on the drawings. The terminals shall be rated for copper or aluminum conductors.
5. The loadcenter shall be designed to accept a surge arrestor breaker that mounts inside the panel in a 2-pole breaker position. The surge arrestor will not reduce the quantity of useable breaker spaces. It shall be equal to Murray, model MSA2020SPDP
6. Ground fault circuit interrupters (GFCI) shall be installed where shown on the schedule.

F. Bus

1. The bus bar shall be copper for all installations.

G. SERVICE Entrance

1. The panel shall be labeled for use as service entrance equipment.

2.08 UNDERGROUND DUCTBANKS

A. General: Furnish and install the ductbanks and extension of existing as herein specified and as shown on the drawings.

B. Division of Work:

1. The General Contractor shall be responsible for the work and material required for the following:

a. Excavation
b. Backfill
c. Concrete envelope for conduits including reinforcing rods and tie down rods.
d. Brick or concrete collars to bring manhole frames and covers up to grade. Installation of frames and collars, which are to be furnished by the Electrical Subcontractor.

2. All other material, equipment, and labor required for the complete ductbank extension shall be furnished and installed by the Electric Subcontractor under this Section, including the following:

   a. Service raceways.
   b. Grounding material.
   c. Detectable Ductbank warning tape. Equal to Ideal model, 42-251
   d. Pre-cast manholes.

C. Materials

1. Conduit: Type Schedule 40 PVC where installed in concrete envelope. See BASIC MATERIALS SECTION.
2. Conduit Supports (duct system): Shall be molded plastic with interlocking lugs and skeletonized structure, minimum separation 3".
3. Tags: Non-ferrous metal or fiber, ¼" high letters.
4. Detectable Warning tape shall be solid aluminum foil, 6" wide, as manufactured by Ideal Industries, and shall be installed above all ductbanks both high and low tension.

D. Duct System

1. The duct system shall consist of Schedule 40 PVC conduit encased in concrete except where otherwise specified. The size and number of conduits shall be as indicated on the drawings. Provide a pull wire in each conduit.
2. The entire length between manholes and end of ductbank shall be excavated and graded before any conduit is laid.
3. The ductbank shall be set on undisturbed earth.
4. The conduit shall be installed so that top of concrete is a minimum of 36" below finished grade unless otherwise indicated, and shall be laid to a minimum grade of 4" for each 100 feet of length. Duct system shall drain to manholes.
5. Changes in direction shall be made by long sweep bends, minimum radius 25 feet except that at the end of a run, within 10 feet of termination. Manufactured ends may be used having a minimum radius of 48 inches.
6. Conduit base and intermediate spacers shall be installed a maximum of 5 feet on centers. Spacers shall not be placed one above the other, but shall be staggered a minimum of 6".
7. All conduit joints shall be made watertight by means of a sealing compound before the coupling is installed. Joints in conduit shall be staggered, minimum space between joints in adjacent conduit shall be 6".
8. When the required number of conduits has been installed, securely tie the assembly together at distances not exceeding 7 feet. Tie shall consist of

three (3) turns of No. 18 iron wire. Separate ties required for low tension and high tension conduit runs.

9. Duct envelope shall be of monolithic construction and shall be vibrated to eliminate voids.
10. Pouring of concrete shall be continuous throughout the length of construction. The end of the pour shall be interlocked or sloped. If the installation is halted, the ends of conduit shall be plugged.
11. Concrete shall not be poured until the conduit installation has been observed by the Architect.
12. Detectable Warning tape shall be installed during backfilling and shall be placed approximately 12" above the concrete encasement.
13. After the installation in completed, each conduit shall be cleaned and identified. A standard flexible mandrel and a stiff bristle brush shall be pulled through each conduit. The mandrel shall not be less than 12" long and the diameter approximately ¼" less than the conduit.
14. Manholes shall be furnished and installed by electrical Subcontractor. Provide frames and covers as indicated on the drawings.

PART 3 - EXECUTION

3.01 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.

B. Particular attention shall be directed to coordination of lighting fixtures and other electrically operated equipment requiring access which is to be installed in ceiling areas. Coordinate with other trades, the elevations of equipment in hung ceiling areas to insure adequate space for installation of recessed fixtures before said equipment is installed. Conflicts in mounting heights and clearances above hung ceilings for installation of recessed lighting fixtures or other electrically operated equipment requiring access shall be brought to the attention of Architect for a decision prior to equipment installation.

C. Furnish to General Contractor and other subcontractors information relative to portions of electrical installation that will affect other trades sufficiently in advance so that they may plan their work and installation.

D. Obtain from other trades information relative to electrical work which he, the Electrical Subcontractor, is to execute in conjunction with installation of other trades' equipment.

E. Lighting fixtures in mechanical spaces or utility/ storage rooms shall only be installed after all mechanical equipment is in place.

3.02 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.

3.03 IDENTIFICATION

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

1. Provide screw on nameplates on switchboards, panel boards, 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. Nameplates on panel boards shall have the following information.

a. Line 1 - Panel designation in 1/2" high letters.
b. Line 2 - Utilization voltage in 3/8" high letters.
c. Line 3 - Distribution source "Fed from ____" in 1/4" high letters.
d. Neatly typed directory cards listing circuit designations shall be fastened inside the cover of panel boards. Spare circuits shall be penciled.
e. Color coding schedules. If there is more than a single system voltage, different voltages shall have secondary switchboard and distribution panel and shall be of the phenolic nameplate type as previously specified. A typewritten color code schedule shall also be affixed, under plastic, inside each panel board door.
f. Outlet boxes both concealed and exposed shall be identified as to panel origination and circuit number by means of fibre pen on the inside of cover plate.
g. All conductors in boxes larger than standard outlet boxes, in all wireways, trench headers, etc. shall be grouped logically and be identified.
h. Grounding conductors and neutrals shall be labeled in panels, wireways, etc. as to circuits associated with.

3.04 PROTECTION AND CLEANUP

A. Protection

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

a. During progress of work, pipe and equipment openings shall be temporarily closed so as to prevent obstruction and damage.
b. Be responsible for maintenance and protection of material and equipment until final acceptance.

B. Cleanup

1. Keep job site free from accumulation of waste material and rubbish. Remove all rubbish, construction equipment, and surplus materials from site and leave premises in a clean condition.

    a. At completion, equipment with factory finished surfaces shall be cleaned and damaged spots touched up with the same type paint applied at factory.
    b. Particular attention is called to Article 110 12(c) of the NEC, which requires that internal parts of electrical equipment not be contaminated by construction operations.

3.05 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.

3.06 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.

3.07 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.

    a. 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.
    b. Panelboards for lighting, power, telephone, and other auxiliary systems - 78" to top.

c. Equipment located in lobbies shall be located as detailed on architectural drawings or as directed by Architect.
d. Exterior and interior wall brackets shall be as detailed on architectural drawings or as directed by Architect.

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.

3.08 WORKMANSHIP AND INSTALLATION METHODS

A. Work shall be installed in first class manner consistent with best current trade practices. Equipment shall be securely installed plumb and/or level. Flush mounted outlet boxes shall have front edge flush with finished wall surface. No electrical equipment shall be supported by work of other trades. Cable systems shall be supported and not draped over ducts and piping or laid on ceiling suspension members. Lighting fixtures shall be installed to agree with Architects reflected ceiling plans.

B. Supports

1. Support work in accordance with best industry practice and by use of standard fittings.
2. In general, walls and partitions will not be suitable for supporting weight of panelboards, dry type transformers and the like. Provide supporting frames or racks extending from floor slab to structure above.
3. Provide supporting frames or racks for equipment, intended for vertical surface mounting in free standing position where no walls exist.
4. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of equipment.
5. Provide 3/4" thick painted plywood mounting surfaces in all electric and telephone areas and for all equipment on free standing racks. All plywood shall be fire retardant and painted both sides and edges with 2 coats of white paint.
6. No work for exposed installations in damp locations shall be mounted directly on any building surface. In such locations, flat bar members or spacers shall be used to create a minimum of 1/4" air space between building surfaces and work.
7. Nothing (including outlet, pull and junction boxes and fittings) shall depend on electric raceways or cables for support. All outlet, pull, and junction boxes shall be independently supported.
8. Nothing shall rest on, or depend for support on, suspended ceiling or its mounting members.

9. From outlet box by means of an interposed metal strap, where weight is less than five pounds.
10. From outlet box by means of a hickey or other direct threaded connection, where weight is from five to fifty pounds.
11. Directly from structural slab, deck or framing member, where weight exceeds fifty pounds.
12. Where support members must of necessity penetrate air ducts, provide airtight sealing provisions which allow for a relative movement between the support members and the duct walls.
13. Provide channel sills or skids for leveling and support of all floor mounted electrical equipment.
14. Where permitted loading is exceeded by direct application of electrical equipment to a slab or deck, provide proper dunnage as required to distribute the weight in a safe manner.
15. Support metallic raceways by either running within steel frame or hung from the building frame. Anything hung from building frame shall be attached with metallic fasteners.

C. Fastenings

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

    a. Where weight applied to attachment points is 100 pounds or less, fasten to building elements of:
    b. Wood - with wood screws.
    c. Concrete and solid masonry - with bolts and expansion shields.
    d. Hollow construction - with toggle bolts.
    e. Solid metal - with machine screws in tapped holes or with welded studs.
    f. Where weight applied to attachment points exceeds 100 pounds, fasten as follows:
        1. At field poured concrete slabs, provide inserts with 18" minimum length slip through steel rods, set transverse to reinforcing steel.
        2. Where building is steel framed, utilize suitable auxiliary channel or angle iron bridging between structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.
    g. Floor mounted equipment shall not be held in place solely by its own dead weight. Provide floor anchor fastenings. Floor mounted

equipment over 72 inches in height shall also be braced to nearest wall or overhead structural elements.

h. For items which are shown as being mounted at locations where fastenings to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging to building structural elements.

i. Fastenings for metallic raceways using the fastening as support shall be of the metallic type. Fastenings to hold raceways or cables in place may be via tie wraps.

D. 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.

a. Raceways for normal emergency or emergency only wiring cannot contain other conductors.

b. Raceways shall be properly aligned, grouped, and supported in accordance with code. Exposed raceways shall be installed at right angles to or parallel with structural members. Concealed raceways may take most direct route between outlets.

c. Raceways run on trapeze hangers shall be secured to the trapeze.

d. Raceways shall be continuous and shall enter and be secured to all boxes in such a manner that each system shall be electrically continuous from service to all outlets. Provide grounding bushings and bonding jumpers where raceways attach to painted enclosures or terminate below equipment.

e. Where raceways enter boxes, cabinets, tap boxes, other than those having threaded hubs, a standard locknut shall be used on the outside and locknut and bushing on the inside.

f. Where raceways terminate below equipment and there is no direct metal-to-metal continuity, provide grounding bushings on raceways and interconnect with equipment grounding conductor.

g. All empty raceways shall be provided with a pull wire.

h. All raceway sleeves, stub ups, or stub outs, where not connected to a box or cabinet, shall be terminated with a bushing.

i. All raceway joints shall be made up tight and no running threads will be permitted.

j. Where raceways are cut, the inside edge shall be reamed smooth to prevent injury to conductors.

k. All vertical raceways passing through floor slabs shall be supported.

l. Raceways shall not be installed in concrete slabs above grade or below waterproofed slabs.

m. Electric raceways and/or sleeves passing through floors or walls shall be of such size and in such location as not to impair strength of construction. Where raceways alter structural strength or the installation is questionable, the structural engineer shall be contacted for approval.

n. Raceways shall not run directly above or below heat producing apparatus such as boilers, nor shall raceways run parallel within 6 inches of heated pipes. Raceways crossing heated pipes shall maintain at least a 1 inch space from them.

o. Raceways shall be installed in such a manner as to prevent collection of trapped condensates, and all runs shall be arranged to drain.

p. Raceways passing between refrigerated and non-refrigerated spaces and those penetrating enclosures with air movement shall be provided with seals.

q. Where two alternate wiring methods interconnect such as EMT to flexible metal conduit, an outlet box shall be provided.

r. All empty raceways entering building and all sleeves or core drilled openings through floors shall be sealed.

s. Each exterior raceway or assembly in a ductbank shall be provided with continuous detectable warning tape installed 12 inches above raceway or ductbank.

t. Underground rigid non-metallic raceways where allowed and run as a ductbank encased in concrete shall be installed with plastic spacers to ensure a separation of 3 inches between raceways. Top of ductbanks shall be 30 inches below grade, unless otherwise detailed.

u. Elbows and extensions of rigid non-metallic raceway systems which penetrate slabs shall be rigid or intermediate metal conduit.

v. Raceways used for transformer connections shall be flexible type and shall contain a grounding conductor.

w. Raceways entering building through foundation wall into a basement area shall be provided with wall entrance seals or with other acceptable waterproofing method.

E. General Outlet Box Installation:

1. Boxes shall be set flush with finish surface and provided with proper type extension rings or plaster covers. Through-the-wall boxes are not permitted. Check device or fixture to be mounted to box to ensure box orientation is proper.

a. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operation.
b. Remove knockouts only as required and plug unused openings.
c. Where required for horizontal and vertical alignment of boxes in stud partitions, bar hangers spanning two studs shall be used. Device boxes for insertion type receptacles shall be provided with far side box supports where there are less than two entering nonflexible raceways, and where bar rangers are not provided.
d. Boxes flush mounted in fire rated partitions and on opposite sides of the partition shall be separated by a distance of 24 inches in accordance with UL listing for the box.
e. Locations of outlets indicated on drawings are approximate. For items exposed to view, refer to architectural drawings and coordinate locations with masonry joints, panel joints, ceiling grids, structural members, etc.
f. In case of conflict with standard mounting heights and device alignment, consult Architect prior to roughing.
g. Check all door swings on architectural drawings to ensure lighting switches are installed on strike side of door.
h. The right to make any reasonable change in location of outlets prior to roughing is reserved by Architect. "Reasonable change" shall be interpreted as movement within 10 feet of location shown.
i. Obtain dimensioned plan from Architect for floor outlets.
j. Outlet boxes for use where surface metal raceways are allowed shall be of a type specifically designed to be used with such surface metal raceway systems.

F. Conductor Installation

1. No conductors shall be pulled into individual raceways until such raceway system is complete and free of debris. No harmful lubricants shall be used to ease pulling.

a. All conductors shall be wired so that grounded conductor is unbroken; switches in all cases being connected in ungrounded conductor.
b. Connections throughout the entire job shall be made with solderless type devices of approved design satisfactory to Inspector of Wires.
c. All taps and splices shall be insulated equal to that of conductor insulation.
d. All conductors of each feeder in pull boxes etc. shall be grouped, tied together, supported, and identified.

e. All conductors in panelboards and other wiring enclosures shall be neatly formed and grouped.
f. All conductors of emergency only and/or normal/emergency shall be run in separate raceway systems to final outlet box.
g. Provide support for conductors in vertical raceways in accordance with Article 300 19.
h. Strip insulation from conductors with approved tools and only of sufficient length for proper termination. Cutting of conductor stranding is unacceptable.
i. Taps from paralleled conductors shall be of a type which tap each conductor, such as ILSCO "PTA" series.
j. Grounding conductors are to be identified as to associated power circuits.

G. Type MC Cable Installation

1. Where cable is permitted under the products section, the installation of same shall be done in accordance with code and the following:

a. Cable shall be supported in accordance with code. Tie wire is not an acceptable means of support. Horizontally run cable supports such as Caddy WMX 6, and clamps on vertical runs such as Caddy CJ6 shall be used. Where cables are supported by the structure and only need securing in place, then tie raps will also be acceptable. Ty raps are not acceptable as a means of support. All fittings, hangers, and clamps for support and termination of cables shall be of types specifically designed for use with cable, i.e., romex connectors not acceptable.
b. Armor of cable shall be removed with rotary cutter device equal to roto split by Seatek Co., not with hacksaw.
c. Use split "insuliner" sleeves at terminations.
d. Any cable system used in conjunction with isolated ground circuits shall have both an isolated ground conductor and an equipment ground conductor.

H. Stranded Conductor Installation

1. If Contractor selects stranded conductors for # 10 AWG and smaller, terminate such conductors as follows:

a. No stranded conductor may be terminated under a screw head. Provide insulated terminal lugs for all screw connections equal to Thomas & Betts "STA KON" type RC with forked tongue and turned up toes. Installation of lugs shall be done with compression

tool such as T&B WT 145C which prevents opening of tool until full compression action is completed.

b. Backwired wiring devices shall be of clamp type; screw tightened. Force fit connections not allowed.

c. Stranded conductors will not be allowed for fire alarm work.

I. Accessibility

1. Electrical equipment requiring service or manual operation shall be accessible.

a. Work switches for equipment within accessible hung ceiling spaces, such as fan powered terminal boxes, shall be located at terminal box, and so located so as to be accessible.

J. Vibration Elimination

1. All equipment connections to rotating equipment or equipment capable of vibration shall be made up by flexible raceways.

K. Wiring Device Gaskets

1. Provide wiring device gaskets at coverplates where device is mounted in wall separating conditioned and non-conditioned spaces.

3.09 FEEDER CIRCUITS

A. Provide feeders as called for on the drawings.

3.10 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.

B. Physical arrangement of branch circuit wiring shall correspond to circuit numbering on drawings. Ground fault circuit breakers and isolated ground outlets shall be wired with separate neutrals and separate grounding conductors per circuit. A consistent phase orientation shall be adhered to throughout project at terminations.

C. Circuits feeding three-phase equipment shall not be combined into common raceways, unless specifically indicated.

D. All wiring in panelboards and cabinets shall be neatly formed and grouped.

3.11 FIREPROOFING AND WATERPROOFING

A. Examination

1. Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of firestopping in accordance with manufacturer's installation instructions and technical information.

B. Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.

C. Provide masking and temporary covering to protect adjacent surfaces.

D. Do not proceed until unsatisfactory conditions have been corrected.

E. Installation

1. General: Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
2. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of firestopping products.

F. Field Quality Control

1. Inspections: Owner shall engage qualified independent inspection agency to inspect through-penetration firestop systems.
2. Keep areas of work accessible until inspection by authorities having jurisdiction.
3. Where deficiencies are found, repair firestopping products so they comply with requirements.

G. Adjusting and Cleaning

1. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
2. Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

H. Schedules

	Concrete Floor	Concrete Wall	Gypsum Board Wall
Penetrant Type			
Blank Opening	C-AJ-0100, C-AJ-0101	C-AJ-0100, C-AJ-101	
Metal Conduits	C-AJ-1080, C-AJ-1240, C-AJ-1353	C-AJ-1080, W-J-1098, W-J-1100	W-L-1049, W-L-1222, W-L-1168
Plastic Conduits/ Raceways	C-AJ-2140, C-AJ-2292	W-J-2018, W-J-2076	W-L-2093, W-L-2241
Cables	F-A-3021, F-A-3037	W-J-3098, W-J-3130, W-J-3158, W-J-3180	W-L-3218, W-L-3255, W-L-3306, W-L-3377

3.12 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.

B. Patching will be provided by the trade responsible for the surface to be patched.

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, branch circuits and emergency systems shall be tested in accordance with the following. In general, all tests shall be done in accordance with the 2009 Acceptance Testing Specifications of the International Electrical Testing Association.

B. The Testing Subcontractor may be an independent contractor or a manufacturer of the equipment which is to be tested.

C. Test report forms, delineating tests to be made, and method of recording same shall be submitted prior to commencing work. Test reports when submitted shall include interpretation of results and recommendation for any corrective work required.

D. Load centers

1. Visual Inspection:

a. Check for foreign material within bus enclosure.
b. Check for missing hardware.
c. Inspect entire assemblies for transit damage or factory defects.
d. Check for all bus dimensions and bracing per specifications.
e. Check ratings of all protective relays per drawings.
f. Physical Inspection:
g. Torque all bus hardware to proper tension.
h. All doors and hinged panels open and close properly.
i. All circuit breakers operate, close and trip mechanically.
j. Torque all feeder conductors to terminal manufacturers' recommendations.

E. Conductors: All secondary service conductors and all feeder conductors from switchboards and distribution panels shall be tested.

1. Visual and mechanical inspection

a. Conductors to be inspected for physical damage and proper connection and sizing in accordance with single line diagram.
b. Conductor connections shall be torque tested to manufacturer's recommended values.
c. Electrical Tests
d. Perform insulation resistance test on each conductor with respect to ground and adjacent conductor.
e. Perform continuity test to insure proper conductor connection.

3.14 WORKMANSHIP

A. All work shall be done in a workman-like fashion of the highest standards in the telecommunications industry.

B. All equipment and materials are to be installed in a neat and secure manner, while cables are to be properly dressed.

C. Workers must clean any debris and trash at the close of each workday.

3.15 DEMOLITION, REMOVAL, AND RELOCATION WORK

A. The Electrical Subcontractor shall be responsible for disconnection and making dead of existing electrical equipment and wiring systems no longer needed within the renovated areas. Removal of existing fixtures, wiring, raceways, boxes, cabinets, devices, etc. within the renovated area, and store at a single location in the building where work is being done.

B. Where devices are to be removed, existing conductors shall be removed back to the last outlet which is to remain.

C. Existing raceways, boxes, and other electrical devices which serve equipment being removed shall be removed also. Where they are installed wither surface, concealed, or flush mounted within or on walls or in ceilings which are being removed, they shall be removed completely. Where they are in or on existing walls or in ceilings which are to remain, surface raceways and boxes shall be removed, but flush mounted raceways and boxes may be abandoned in place. If such remaining walls or ceilings are being refinished with a new surface material, the flush boxes shall be made to be back far enough from the surface so the new surfacing material may be installed without interruption. Where only a new finish such as paint is to be applied and the architect agrees, the existing boxes shall be covered with blank plates.

D. Any existing equipment that is to remain, made dead by removal of other equipment, shall be refed for a complete and operating system at no additional cost to the Owner.

E. All equipment removed shall be stockpiled in a location specified by the Owner. Any equipment not wanted by the Owner shall be removed from the site and properly disposed of by this Contractor. Provide certificates attesting to legal disposal of any electrical materials classified as hazardous.

F. The Contractor should expect that the installation of new construction and/or equipment both by the Electrical Subcontractors and other Contractors or Subcontractors may necessitate minor relocations of existing electrical equipment such as pull or junction boxes. The installation of new large size equipment such as ductwork and fan boxes takes precedence over existing small electrical equipment such as raceways, pull or junction boxes. Such equipment in the way of new construction or equipment shall be relocated as necessary without additional cost to the Owner.

END OF SECTION

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Not Used

SECTION 31 00 00 - EARTHWORK

PART 1 - GENERAL

1.1 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.

B. Examine all Drawings and all other Sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

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

1.2 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment and supervision necessary to complete work specified in this Section.

B. The following list of items is to be used as a guide and shall not be considered as limiting the scope of the work.

1. Excavating, filling, backfilling and grading as required for the construction of paving, site improvements and other site work.
2. Providing, furnishing and placing of all fill and backfill materials as specified herein, as shown on the Drawings or as required.
3. Compaction procedures.
4. Protecting all existing structures, utilities, pavements, planting and other site improvements from damage due to construction.
5. Performing all dewatering necessary to maintain excavated areas free from water from any source.
6. Removing and disposing of all unsuitable and surplus excavated materials from the site.
7. Rock removal in areas of site improvements.
8. Installation of memorial stone.

1.3 RELATED WORK UNDER OTHER SECTIONS

A. Section 02 41 13 – SITE PREPARATION

B. Section 03 30 00 – CAST IN PLACE CONCRETE

1.4 REFERENCES

A. References herein to any technical society, organization, group or body are made in accordance with the following abbreviations and, unless otherwise noted or specified, all work under this Section shall conform to the latest edition as applicable:

B. A.S.T.M. American Society for Testing and Materials.

1. ASTM C136 – Method for sieve analysis of fine and coarse aggregates.
2. ASTM D1557 – Test methods for moisture-density relations of soils and soil-aggregate mixtures using ten-pound hammer (10 lb.) and eighteen-inch (18”) drop.

3. ASTM D2922 – Test methods for density of soil and soil-aggregate mixtures in place by nuclear methods (shallow depth).

C. A.A.S.H.T.O. American Association of State Highway and Transportation Officials.

D. S.S.H.B. – Commonwealth of Massachusetts Department of Transportation Standard Specifications for Highway and Bridges, 2024 or lates edition as well as all supplements.

E. O.S.H.A. – Occupational Safety and Health Administration

F. MassDEP – Massachusetts Department of Environmental Protection

1. Massachusetts Contingency Plan (MCP) 310 CMR 40.000
2. Air Pollution Control Asbestos 310 CMR 7.15

G. EPA – United States Environmental Protection Agency

H. Hazardous Waste Management (40 CFR 260-263, 268, and 270-272)

1.5 DEFINITIONS

A. Fill and backfill shall be, for the purpose of this Specification, considered interchangeable terms and shall mean material to be used to bring existing or construction grades up to finish subgrade levels.

B. The words "Finish Grade" as used herein mean the required final grade elevations indicated on the Drawings. Where not otherwise directed, areas outside buildings shall be given uniform slopes between points for which finish grades are shown, or between such point and existing grade, except that vertical curves or roundings shall be provided at abrupt changes in slope.

C. The word "subgrade" as used herein, means the required surface of subsoil, borrow fill or compacted fill. This surface is immediately beneath the site improvements, specially dimensioned fill, paving, loam or other surfacing materials.

D. Excavation is defined as the removal of materials from the construction area to the lines and grades shown on the plans.

1. Unclassified Excavation is defined as the removal of all material encountered regardless of its nature. All material excavated will be considered as Unclassified Excavation unless the Special Provisions specify Classified Materials.

E. "Unsuitable Materials" shall include the following:

1. Pavements, utility structures, building foundations and other manmade structures.
2. Peat, muck, organic silt and other organic materials subject to decomposition, consolidation or decay.
3. Miscellaneous fill including cinders, ash, glass, wood, masonry and metal.
4. Ledge and boulders except as specified herein for fills.

1.6 EXAMINATION OF CONDITIONS

A. The Contractor shall fully inform himself of existing conditions of the site before submitting his/her bid, and shall be fully responsible for carrying out all site work required to fully and properly execute the work of the Contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of

actual conditions inconsistent with those assumed, except those conditions described in the GENERAL CONDITIONS.

B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct to the best of the Owner's Representative's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found therein.

1.7 QUALITY ASSURANCE

A. The Contractor shall retain and pay for the services of an independent testing and inspection firm and/or a Geotechnical Engineer to perform on-site observation and testing during the various phases of the construction operations. The scope of services will be determined by the Owner's Representative and the independent testing and inspection firm and/or the Geotechnical Engineer and will be provided to the Contractor. The Owner's Representative reserves the right to modify or waive the services of the independent testing and inspection firm and/or the Geotechnical Engineer. The services of a Geotechnical Engineer/Inspection and testing firm may include, but shall not necessarily be limited to, the following:

1. Laboratory testing and analysis of fill materials as specified herein and proposed by the Contractor for incorporation into the Work.

B. The Contractor shall make provisions for allowing observations and testing of Contractor's Work by the independent testing and inspection firm.

C. The presence of the independent testing and inspection firm does not include supervision or direction of the actual work of the Contractor, his/her employees or agents. Neither the presence of the independent testing and inspection firm, nor any observations and testing performed by them, nor failure to give notice of defects shall excuse the Contractor from defects discovered in his/her work.

D. Costs related to re-testing due to unacceptable qualities of work and failures discovered by testing shall be paid for by the Contractor at no additional expense to Owner.

1.8 PROTECTION

A. All rules and regulations governing the respective utilities shall be observed by the Contractor in executing all work under this Section. All work shall be executed in such a manner as to prevent any damage to existing buildings, streets, curbs, paving, service utility lines, structures and adjoining property.

B. Locate and mark underground utilities to remain in service before beginning the work. Protect all existing utilities to remain during operations. Do not interrupt existing utilities except as authorized in writing by authorities having jurisdiction.

C. When an active utility line is exposed during construction, its location and elevation shall be plotted on the record drawing by the Contractor, and both the Owner's Representative and the Utility Owner notified in writing.

D. Conduct earthwork operations to ensure minimum interference with streets, walks, and other adjacent facilities. Do not close or obstruct streets, walks, etc. without written permission from authorities having jurisdiction. Provide barricades, fences, signs and all other safety devices required for the protection of the public.

E. Provide all protections necessary for archaeologically significant resources as per Massachusetts Historical Commission findings.

1.9 SAMPLES AND TESTING

A. All operations under this Section of the Specifications will be subject to the continuous observation of the Owner's Representative, and of a soils testing laboratory, engaged and paid directly by the Contractor. The Owner's Representative shall direct testing to determine conformance of materials and workmanship, particularly compaction, to the requirements of this Specification.

1. The laboratory shall make such tests of materials and compaction. Costs of the tests shall be borne by the Contractor. Test copies shall be submitted to the Owner's Representative directly from the approved independent testing company.
2. Contractor shall provide a five-gallon bucket minimum sample of each fill material from each proposed source including on-site materials that are planned to be re-used. Additional samples shall be provided if a change in material type occurs at the borrow source. Allow minimum of two weeks for testing evaluation before materials needed. Do not deliver proposed fill materials to the site unless/until the Landscape Architect has approved of material testing results. Submit samples from alternate sources if intended for use.
3. The laboratory will defer testing on an area until the Contractor states that he/she has reached the specified compaction of the particular area. Areas for which tests indicate insufficient compaction shall be re-compacted and retested until the areas conform to the requirements of the Specifications. All costs for retesting material shall be borne by the Contractor.

B. Compaction Tests

1. At all new pavements and under site walls. Tests will be provided for subgrade materials. Final locations will be coordinated with the Owner's Representative.

1.10 SOIL TESTING

A. Materials will be tested and observed as described in the following paragraphs. Cooperate by allowing free access to the work for selection of test materials and observations.

1. Testing methods shall comply with the latest applicable ASTM Standards specified.
2. During subgrade preparation, before placement of bedding material, concrete work mats, structural fill, or structural concrete, the Testing Firm/Geotechnical Engineer shall observe the subgrade and perform in-place soil density tests as required to confirm that the bearing characteristics of the subgrade are consistent with those anticipated in the geotechnical investigations. Earthwork activities performed without properly scheduled inspection are subject to removal and replacement or additional testing as directed by the Owner's Representative at no expense to the Owner.
3. During the placement of bedding, backfill and fill, in-place soil density testing shall be performed by the soil testing agency to confirm that fill material has been compacted in accordance with the requirements of this Section. The Testing Firm/Geotechnical Engineer may designate areas to be tested. Contractor shall notify Engineer at least 72 hours in advance of scheduled compaction testing.

    a. Structures and Embankments. At least one density and moisture content test for each 2,500 square feet of surface area for each lift of fill at embankment, structure and manhole locations.
    b. Trench Excavations. At least one nuclear density and moisture content test shall be conducted at a maximum of 50-ft intervals for each lift of fill placed or as directed by the Owner's Representative.
    c. A minimum of 2 tests per lift.
    d. Additional tests as determined by the Owner's Representative.

1.11 COORDINATION

A. Prior to start of earthwork the Contractor shall arrange an on-site meeting with the Owner/Owner's Representative, the independent testing firm, and the Engineer for the purpose of establishing the Contractor's schedule of operations and scheduling observation and testing procedures and requirements.

B. As construction proceeds, the Contractor shall be responsible for notifying the Owner's Representative a minimum of three (3) working days prior to the start of earthwork operations requiring observation and/or testing.

1.12 SUBMITTALS

A. Submit, in an airtight container to the Inspection/Geotechnical Engineer's and testing firm's designated testing laboratory, a minimum of a five-gallon bucket of each type of fill material that is to be used at the site. Submit samples a minimum of two weeks prior to use of proposed material at the site. Samples submitted for inspection by the Owner's Representative shall be brought to the site. Submit samples to the testing laboratory and the Owner's Representative. No fill material shall be delivered to the site or placed until the material has been approved.

B. The Owner's Representative will be responsible for the approval or rejection of the suitability of all materials.

C. Submit the name of each material supplier and specific type and source of each material. Any change in source throughout the job requires approval of the Owner or Owner's Representative.

D. All off-site material brought to the site shall be free of contaminants. In the event that site characterization of off-site borrow sources indicates that soils are acceptable to the Owner's Representative for use, then chemical testing will not be required. It is anticipated that chemical testing would not normally be required for material from customarily utilized commercial borrow sources.

If the materials are suspected of being contaminated based on review of the site characterization data, chemical testing will be required as directed by the Owner's Representative. The chemical testing shall be completed by the Contractor at no additional cost to the Owner. At a minimum, environmental testing shall include:

1. Total Petroleum Hydrocarbons (TPH) by ASTM D3328/EPA Method 8100
2. Metals (RCRA 8) by EPA Methods 6010/7471A
3. Semi-volatile organic compounds (SVOCs) by EPA Method 8270
4. Polychlorinated Biphenyls (PCBs) by EPA Method 8082
5. Volatile organic compounds (VOCs) by EPA Method 8260
6. Asbestos

E. Despite review and comment by the Owner's Representative, the Contractor shall remain solely responsible for the adequacy and safety of materials and methods used in construction.

F. Product literature, Material Safety Data Sheets, and installation requirements for all products

1.13 BENCH MARKS AND ENGINEERING

A. Lines and grade work in accordance with Drawings and Specifications shall be laid out by a registered Civil Engineer or Surveyor employed by the Contractor. The Contractor shall establish permanent bench marks, to which access can easily be had during the progress of the work. The Contractor shall maintain all established bounds and bench marks and replace, as directed, any which may be disturbed or destroyed. The selection of the registered Civil

Engineer or Surveyor shall be subject to the Owner's Representative's approval. The Contractor shall pay all costs of the services of the Civil Engineer or Surveyor.

B. The Contractor shall verify dimensions and elevations on the ground and report any discrepancies immediately to the Owner's Representative. Any discrepancies not reported prior to construction shall not be the basis for claims for extra compensation.

1.14 SUBSURFACE INFORMATION

A. By submitting a bid, the Contractor affirms that the site and all conditions affecting the work under this Section have been carefully examined. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions as indicated in the Contract Documents, or obvious from observations at the site.

1.15 PROTECTION

A. All rules and regulations governing the respective utilities shall be observed in executing all work under this Section.

B. All work shall be executed in such a manner as to prevent any damage to existing streets, curbs, paving, service utility lines, structures and adjoining property. Contractor shall assume full responsibility for damages caused to such by his/her Subcontractor's equipment and personnel.

C. The work of this Section shall be performed in such a manner as to cause no interference with access by the Subcontractors or other Contractors to all portions of the site as is necessary for the normal conduct of their work.

1.16 EXISTING CONDITIONS

A. Subsurface Information: The Owner's Representative assumes no responsibility for the Contractor's failure to make his own site investigation and makes no representation regarding the character of the soil or subsurface conditions which may be encountered during the performance of the work. Bidders are expected to examine the site and then decide for themselves the character of materials to be encountered.

B. Existing Utilities

1. Before starting earthwork, locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.
2. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility Owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of Owner.
3. Do not interrupt existing utilities serving facilities occupied or used by Owner and others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided. Provide a minimum of 48 hour notice to Owner, and receive written notice to proceed before interrupting any utility.

C. Retaining Structures: Provide bracing, shoring, sheeting, temporary tie backs, rock anchors and rock bolts, sheet piling, underpinning or other retaining structures necessary to prevent any movement or settlement of existing or new construction, utilities, paving, piping or conduit.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. ORDINARY FILL shall conform to the requirements of Section M1.01.0 of MassDOT. In addition it shall be clean, mostly granular, natural inorganic soil. It shall be free of organic or other weak or compressive materials, frozen materials, cinders, trash, rubble and stone larger than six (6) inches maximum dimension.

1. Material from excavation on the site meeting the above requirements may be used as ordinary fill provided it has not been contaminated with unsuitable material.

B. GRANULAR FILL for borrow shall conform to the requirements of Section M1.03.0, Type c of MassDOT.

C. GRAVEL, as noted in the Drawings, shall be DENSE GRADED CRUSHED STONE conforming to the requirements of Section M2.01.7 of MassDOT.

D. CRUSHED STONE shall conform to the requirements of Section M2.01.4 of MassDOT for 3/4” maximum sieve size.

E. FILTER FABRIC: one of the following:

1. US 90NW as manufactured by US Fabrics.
2. AEF 480HS as manufactured by American Engineering Fabrics, Inc., New Bedford, MA.
3. 80 NW as manufactured by US Fabrics, Cincinnati, OH.
4. Typar 3201 as manufactured by FiberWeb, Roseville, MN, or approved equal.

2.2 USE OF FILL MATERIALS

A. Granular Fill shall be utilized as fill in the following locations:

1. To replace unsuitable material.
2. All walk embankments to subgrade.
3. Elsewhere as shown on the Drawings or specified. Wherever fill materials such as Ordinary Fill or Gravel have not been specified herein or shown on the Drawings.

B. Gravel shall be utilized as sub-base material for all paved surfaces, where so indicated on the Drawings or specified herein.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavation is "Unclassified", and includes excavation to subgrade elevations indicated, or required to accommodate new construction, regardless of character of materials and obstructions encountered and shall be understood to include rock, shale, boulders, earth, hardpan, fill, foundations, pavements, curbs, piping and debris. It shall include the removal of all rubble, debris, foundations, pavement, utilities and appurtenances to two (2) feet minimum below finish grade.

B. Excavate to the following basic subgrades:

1. Footings and other site improvements: To exact elevations required.
2. Paving: To depths indicated on the Drawings.

C. Unauthorized Excavation: When suitable bearing material is encountered at subgrade elevations shown and excavation is made to greater depth, bring grade back to elevation required by providing granular fill at no additional cost to the Owner's Representative.

D. Rock Excavation

1. The material to be excavated shall be assumed for bidding purposes to be earth and other materials that can be removed by normal power excavation equipment. This includes rock, concrete and other subsurface materials up to and including two [2] cubic yards in volume encountered during excavation. Excavation of this material shall be at the Contractor's expense.
2. Work under this Section shall include an Allowance, for bidding purposes, for the removal of rock, concrete and other subsurface materials up to and including four [4] cubic yards in volume encountered during excavation that can be removed by normal power excavation equipment. Excavation of this material shall be at the Contractor's expense.

    a. Such removals shall be measured by the Contractor by notifying the Owner's Representative prior to the removal. If not performed, credit to the extent of ledge, boulder, or foundation removal less than four (4) cubic yards in the measurements shall be applied to the contract price at a value equal to the median MassDOT unit pricing for rock removal for the MassDOT District in which this project is located. The contract price shall be reduced by the extent of work not undertaken as called for in this Section. The contract price shall be increased, if additional work is authorized by the Owner's Representative and verified by the Owner, at the rate specified above.

3. Rock or ledge shall be defined by MassDOT in accordance with Section 120.22 of MassDOT.
4. When, during the process of excavation, rock is encountered, uncover such materials and free them of loose material. Notify the Owner's Representative before proceeding further. The area in question shall be cross sectioned as stipulated herein. Do not proceed with excavation of material claimed as rock until the material has been classified by the Owner's Representative. Failure on the part of the Contractor to uncover such materials or notify the Owner's Representative or take cross sections will forfeit the Contractor's right of claim to any credits. The quantity of rock to be removed shall be based upon the pay line limits as established herein. The quantity of rock to be removed shall be approved by the Owner's Representative prior to blasting.
5. The Contractor shall employ and pay for a Land Surveyor or Civil Engineer registered in Massachusetts to take cross sections of rock before removal of same and to provide computations of cross sections within the pay line limits. Complete current records of actual quantities of rock excavated, methods of excavation used and extent of labor and equipment involved shall be maintained jointly by the Contractor and Owner's Representative, and shall be dated and signed by both with duplicate copies retained by the Owner's Representative for record. Such records shall include plot plans showing at a suitable scale all elevations, locations and measurements or computed volumes of rock or boulders encountered. All labor and equipment necessary to make these plot plans and take these measurements shall be furnished by the Contractor. No payment will be considered for rock which has been removed without obtaining the above required data.
6. Excavate rock encountered in grading the site areas to depths as follows:

    a. Under utility structure footings and subsurface piping: to six [6] inches below the required subgrade for such footing or piping.
    b. Outside of utility structures: to one [1] foot outside [measured horizontally] of such structure.
    c. Outside of subsurface piping: to six [6] inches outside [measured horizontally] of such piping.

7. Blasting: The use of explosives shall not be permitted.

8. If rock is encountered the Contract Price will be adjusted in accordance with median MassDOT unit pricing for rock removal for the MassDOT District in which this project is located.
9. The additional price for rock removal shall include filling the void created by removal of the rock beyond the indicated limits of excavation with suitable materials in accordance with paragraphs on Fill, Backfill and Compaction at no added cost to the Owner. No allowance shall be made by the Contractor on account of rock or ledge, if encountered, reducing the amount of ordinary fill material available for filling operations, the Contractor being responsible to provide all such required material whether obtained from on or off the site.
10. The Owner's Representative reserves the right to adjust the proposed elevations to conform to any rock conditions.

E. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

F. Dewatering: Prevent water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in the excavations. Remove water to prevent softening of foundation bottoms, undercutting footings and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. 2. Establish and maintain temporary drainage ditches and their diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches. The disposal of water from excavations shall not cause damage to adjacent property and shall be in compliance with all applicable laws and regulations, in particular, those related to protection of water resources and other environmental features.
3. 3. Keep the water level in areas being compacted at least two (2) feet below the level at which compaction is being done at all times. Under no circumstances lay pipe or install appurtenances in water. Keep all trenches free from water until they have been backfilled.

G. Material Storage: Stockpile satisfactory excavated materials where directed until required for backfill or fill. Place, grade and shape stockpiles for proper drainage. Do not store within drip line of trees to remain.

H. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of formwork, installation of services, other construction and for inspection.

I. Frost Protection:

1. Make no excavations to full depth when freezing temperature may be expected unless intended improvements can be accomplished immediately after the excavations have been completed. Protect bottom of excavation from frost if progress is delayed. Protect the subgrade of in place footings from frost. Should protection fail, remove frozen materials and replace with concrete or granular fill as directed at no cost to the Owner.
2. Keep the site clear and free of accumulations of snow within the limit of the Contract lines as necessary to carry out the work of the Contract.
3. Fill materials containing frost shall not be utilized, nor shall filling be done over frozen material.

4. Protect the underside of all in place construction from frost penetration during the construction period of this Contract. Such protection shall include all in place footings and slabs, during all periods of freezing temperatures until such time as the entire project is complete. Minimum frost protection shall consist of a 4 foot thickness of earth, or equivalent in insulating properties.

3.2 BACKFILL AND FILL

A. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

1. Under paving and surfacing: Use subbase material, or satisfactory excavated or borrow material, or combination of both.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade.
2. Backfilling of voids with satisfactory materials.

C. Placement and Compaction: Place backfill and fill materials in uniform lifts of not more than 12 inches in loose depth for ordinary fill and 8 inches in loose depth for other materials compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand operated mechanical compactors.

1. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification.
2. Place backfill and fill materials adjacent to structures, piping or conduit evenly to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately the same elevation in each lift.
3. Do not place any fill material until structural components involved have sufficient strength to withstand the pressure to be imposed. Remove from spaces to be filled all unstable material, including all rubbish, trash, refuse and other debris.
4. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
5. Coordinate backfilling with the installation of the work of all trades.
6. Compact backfill to match adjacent areas as specified above. Correct settlement of fill by filling to subgrade levels in all areas where settlement occurs.
7. No wheel loads are allowed within 3 feet of the slope face. Compact backfill within 3 feet of the slope face by hand operated mechanical compactors.

3.3 SUBGRADE PREPARATION AND GRAVEL PLACEMENT FOR PAVEMENTS

A. Clean the rough subgrade of all loose, soft, foreign or other unsuitable material and reshape as required. Add suitable fill material to meet required grade.

B. Compact to required grades and sections for paving. Tamp traces of trenches. Remove spongy or otherwise unsuitable material and replace with approved material. Loosen exceptionally hard spots and recompact. Take every precaution to obtain a foundation of uniform bearing power. In absence of specific requirement, compact foundation by such means as will provide firm base and insurance against settlement of superimposed work.

C. Roll with wheeled roller having a weight per inch of width not less than 400 pounds. Begin rolling longitudinally at sides, overlapping each pass by one-half of rear wheel. Fill all depressions or settlements which occur. Continue until all stones are firmly interlocked and surface is true and unyielding. Compaction shall be in accordance with these Specifications.

After final rolling, surface is to be free of depressions or irregularities greater than 3/8 inch in 10 feet.

D. Construct base course as detailed on the Drawings for all areas of new paved surfaces in this Section. Placement of gravel base course shall conform to the requirements of MassDOT except as herein modified.

E. Spread gravel from self-spreading vehicles, approved type of power grader or by hand upon prepared subgrade. Spread evenly in layers so as to avoid separation of aggregates. Layers shall not exceed 6 inches in depth after compaction. Remove stones larger than 3 inches. When spread and rolled on the prepared surface, it shall form a stable surface. Compaction shall have a density of not less than 95% of maximum density determined in accordance with AASHTO-T-180 Method D. All rolling shall be done with a roller weighing 8 to 10 tons. Compact any portion which is not accessible to a roller by mechanical or hand tamper.

F. Final rolled surface shall be true to the lines and grades indicated on the Drawings or as directed by the Owner's Representative. Fill any depression that may appear during and after rolling the gravel and re-roll until the surface is true and even. Tolerance shall be 3/8 inch maximum above or below the cross-section grades and 3/8 inch maximum under a 10 foot line longitudinally.

G. Maintain the surface of any layer in its finished condition until succeeding layer is placed. Properly drain the subbase at all times.

3.4 COMPACTION

A. Control soil compaction during construction providing minimum percentage density specified for each area classification.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density of soils which exhibit a well-defined moisture density relationship determined in accordance with ASTM D1557, Method C.

1. Pavements and Site Improvements: Compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent maximum density.

C. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material, to prevent free water from appearing on surface during or subsequent to compaction operations.

1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
2. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry.

3.5 GRADING

A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Grade areas to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:

1. Paved areas: Shape surface of areas under paved surfaces to line, grade and cross section, with finish surface not more than 0.10 foot above or below required subgrade elevations.

C. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

D. Do all cutting, filling, reshaping, re-grading and re-compacting as necessary to meet the requirements of the Drawings and this Section of the Specifications. Maintain subgrades at the levels specified until turned over to subsequent construction. Bring to required subgrade levels any areas where settlement, erosion or other grade changes occur.

3.6 INSTALLATION OF MEMORIAL STONE

A. The memorial stone shall be installed on compacted gravel in the location shown in the drawings. The text of the plaque shall be true and level and facing the road or as directed by the Owner's Representative. The bottom 6" of the memorial stone shall be below finish grade.

3.7 PROTECTION AND REPAIR

A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.

C. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

3.8 DISPOSAL OF UNSUITABLE AND SURPLUS EXCAVATED MATERIALS

A. Remove excess excavated materials, including unacceptable excavated material, trash and debris, and legally dispose of it off the project site.

3.9 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.

B. If in the opinion of the Owner, based on testing service reports and inspection, subgrade of fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

3.10 TESTS

A. Testing laboratory will perform the following general services:

1. Determine maximum dry density and optimum moisture content of soils in accordance with standards herein before specified.
2. Provide optimum moisture - maximum density curves for undisturbed soil used for bearing and material used for compacted fill.
3. Perform Compaction Tests on subgrades and compacted fill layers before construction thereon.

B. Testing laboratory will perform the following field tests:

1. Determine frequency of field tests to assure densities required. Unless otherwise determined, minimum field testing shall be a density test for each 5,000 square feet of undisturbed subgrade and for each 5,000 square feet of overlying compacted fill.

END OF SECTION
31 00 00

SECTION 32 90 00 - LAWNS AND PLANTING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the printed form of the Contract of the City of Worcester and Division 1 of which these specifications are hereby made a part.

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:

B. Preparation of final subgrades in lawns and plant beds; testing, furnishing and spreading of topsoil and planting soil; fine grading; application of soil conditioners; edging and mulching new plant beds; erosion control; broadcasting and hydroseeding of seed mixes; planting of trees, shrubs, perennials and grasses; maintenance, and guarantee.

1.3 RELATED WORK

A. Section 01 57 13 – TEMPORARY EROSION AND SEDIMENTATION CONTROLS
B. Section 31 00 00 – EARTHWORK
C. Section 32 30 00 – SITE IMPROVEMENTS

1.4 REFERENCES

A. ASNS: "American Standard for Nursery Stock", American Association of Nurserymen, 1973 Edition.
B. ASTM: American Society for Testing and Materials.
C. Federal Specification JJJ-S-181b, Seeds, Agricultural.
D. Federal Specification O-F-241c(1), Fertilizers, Mixed, Commercial.
E. SPN: "Standardized Plant Names", American Joint Committee on Horticultural Nomenclature, 1942 Edition.
F. SRA-156: U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act.

1.5 CERTIFICATES, INSPECTIONS, TESTS AND SUBMITTALS

A. Provide a complete soil analysis for topsoil from all sources by a competent laboratory approved by Owner.

1. Perform analysis in accordance with ASTM D422. Include in the analysis tests for physical properties, grain size, hydrogen-ion value, organic matter content and available nitrogen, phosphoric acid, potash and iron. Also include tests for soluble salts, lead and other toxic elements or conditions which may be detrimental to plant growth.
2. Include recommendations for the kinds and quantities of soil amendments to be used in the report of the analysis Submit the report of the analysis to Owner at least 30 days prior to delivery of topsoil to the site or use in the work. The cost of laboratory tests shall be paid by the Contractor.

B. At least 30 days prior to intended use, the Contractor shall provide the following samples and submittals for approval in conformance with the requirements of General Conditions Section 01 33 00, SUBMITTAL PROCEDURES. Do not order materials until Owner's approval of samples, certifications or test results has been obtained. Delivered materials shall closely

match the approved samples. Acceptance shall not constitute final acceptance. The Owner reserves the right to reject on or after delivery any material that does not meet these Specifications.

1. Material Sampling and Testing of Loam Borrow from Off-Site Sources, and Organic Compost shall be specified, performed and paid for under this Section.

    a. No planting soil, loam borrow or compost from off-site sources shall be delivered until the review of samples and test results by the Owner, but such review shall not constitute final acceptance. The Owner reserves the right to reject on or after delivery any material which does not meet specifications or match the sample.

2. Fertilizer: Submit product literature of seeding and planting fertilizers and certificates showing composition and analysis.

3. Seed: Submit a manufacturer's Certificate of Compliance to the Specifications with each shipment of each type of seed. These certificates shall include the guaranteed percentages of purity, weed content and germination of the seed, and also the net weight and date of shipment. No seed may be sown until the Contractor has submitted the certificates.

4. Hydroseeding: Prior to the start of hydroseeding, submit a certified statement for approval as to the number of pounds of materials to be used per 100 gallons of water.

5. All Amendments required to amend a specific soil in order shall meet these specifications.

C. Plants shall be subject to inspection and approval by the Owner at their place of growth, and upon delivery for conformity to specification requirements. Such approval shall not obviate the right of inspection and rejection during the progress of the work.

1. Submit a written request to the Owner at least 10 calendar days prior to digging for inspection of plant materials at their place of growth. State in the written request the place of growth and quantity of plants to be inspected. The Owner reserves the right to refuse inspection at this time if, in his judgment, a sufficient quantity of plants are not available for inspection.

D. Comply with all applicable State and Federal laws in respect to inspection for plant diseases and infestation for all plants including seed. Provide certificates of inspection with the invoice for each shipment as may be required by laws for transportation. File certificates with Owner prior to acceptance of material. Inspection by State and Federal governments at place of growth does not preclude rejection of material at the site.

D. Submit samples of the following materials in the quantities indicated for approval prior to use.

1. Mulch for planting: .5 cubic foot.
2. Compost: .5 cubic foot.

1.6 DELIVERY, STORAGE AND HANDLING

A. Do not deliver TOPSOIL to the site until soil analysis has been approved by the Owner. Do not deliver topsoil to the site in a frozen or muddy condition.

B. Deliver all SOIL AMENDMENTS to the site in manufacturer's standard containers showing weight, analysis, name of manufacturer and warranty. Append a summary of this product information to each invoice. Store in a weatherproof storage place in such a manner that they

will be kept dry and their effectiveness not impaired. Caked or otherwise damaged soil amendments shall be rejected.

C. Deliver SEED in original sealed standard sized containers. Label all seed in accordance with State regulations and SRA-156. Store seed in such a manner that it will be protected from damage by heat, moisture, rodents or other causes. Seed which has become wet, moldy or otherwise damaged shall be rejected.

1.7 QUALIFICATIONS

A. Fine grading and seeded lawn installation shall be performed by personnel familiar with the accepted procedure of lawn construction and planting and shall be under the constant supervision of a qualified foreman.

PART 2 - MATERIALS

2.1 TOPSOIL

A. TOPSOIL stripped and stockpiled as required by Section 31 00 00, EARTHWORK, of these Specifications shall be used for part of this work. It shall be free of any admixture of subsoil, stones larger than one (1) inch, clods of hard earth, plant roots, sticks or other extraneous materials.

1. The Contractor shall be responsible for estimating the quantity of topsoil stockpiled.

B. As required, additional TOPSOIL shall be provided from an off-site source to supplement the existing topsoil stripped from the site. It shall be fertile, friable, natural loam capable of sustaining vigorous plant growth. Topsoil shall be a "sandy loam" or a "fine sandy loam" of uniform composition as determined by mechanical analysis and based on the USDA classification system. In addition it shall meet the requirements above as well as the following mechanical analysis:

Sieve Size	% Retained
1 inch	0
1/2 inch	0-3
No. 100	40-60

1. The clay content of the material passing U.S.S. No. 100 mesh shall not be greater than 60% as determined by the Bouyoucous Hydrometer or by the Decantation Method. The organic content shall be 5% to 20% as determined by the Thomas Rapid Test Method or by loss on ignition on moisture free samples dried at 100 degrees C. The pH value shall be between pH 6.0 and pH 6.5. It shall contain no toxic materials. Soluble salts shall not be greater than 75 parts per million. If soil amendments are required, they shall be added at no additional cost to the Owner.

2.2 SOIL AMENDMENTS

A. GENERAL: All soil amendments shall conform to the standards of the Association of Agricultural Chemists and shall comply with State and Federal regulations.

B. LIMESTONE, if required, shall be free flowing Agricultural Grade Dolomitic Limestone ground to such fineness that 50% will pass a 100 mesh sieve and 98% will pass a 20 mesh sieve. Limestone shall contain at least 50% total oxides and not less than 85% total carbonates.

C. ALUMINUM SULFATE, if required, shall be unadulterated commercial grade.

D. GYPSUM, if required, shall be unadulterated commercial grade Calcium Sulfate.

E. COMMERCIAL FERTILIZER shall be a complete fertilizer, uniform in composition and free flowing. At least 50% of the Nitrogen shall be derived from natural or synthetic organic sources. Available Phosphoric Acid shall be from superphosphate, bone or tankage. Potash shall be derived from Muriate of Potash containing at least 60% Potash. Percentages of Nitrogen, Available Phosphoric Acid and Water-soluble Potash in the fertilizer mix shall be based on laboratory test recommendations as approved by the Owner.

1. Fertilizer for new shrubs and trees shall be 5-10-5.
2. Fertilizer for new lawns shall be 3-1-2.

F. BONEMEAL shall be finely ground commercial raw bonemeal with 4% minimum Nitrogen and 20% minimum Phosphoric Acid.

G. ORGANIC COMPOST shall be mature leaf compost, mature composted animal manure, other aged, composted vegetable materials that meet the requirements of the EPA and the State of Massachusetts for intended use. Raw (uncomposted or unprocessed) organic matter shall not be accepted.

1. Peat moss or other material the harvesting of which depletes natural wetlands shall not be used.
2. Organic material shall contain no bulking agents, such as visible, uncomposted wood chips, and be free from hard lumps. It may be shredded or granular inform. No plastic shall be present. The material shall be free of noxious odor. Organic compost shall be tested for % organics, carbon: nitrogen ratio, ammonium nitrate, moisture content, pH, and sieve analysis and test results shall be submitted for review before use may be approved as a soil component.
3. Manure shall be well rotted, unleached cattle manure, free of harmful chemicals and other injurious substances. Manure shall be free of sawdust and refuse of any kind and shall not contain more than 25% straw, shavings, leaves or other organic material. Manure shall be not be aged more than 2 years or less than 9 months.

H. MYCORRHIZAL FUNGI shall be 'PHC PLANT SAVER 4-7-4' manufactured by Lebanon Seaboard Corporation, tel: 800-233-0628, or approved equal.

1. After plants have been installed and prior to placement of mulch, place 1 packet of "PHC Plant Saver 4-7-4" around the plant in the top 1/2" of planting soil. Work into planting soil so that the material is incorporated.

2.3 PLANTING SOIL

A. PLANTING SOIL for use in new plant beds and as backfill around new shrub and tree plantings shall consist of eight (8) parts topsoil and one (1) part organic compost by volume. It shall have a pH value between 6.0 and 6.5.

2.4 GRASS SEED

A. Shall be fresh, clean, dry, new crop seed which meets the standards of sra-156. Seed shall be of the following varieties, mixed in proportion by weight and testing the minimum percentages of purity and germination. Submit manufacturer's certificates of compliance.

1. Weed seed shall not exceed 0.5% by weight.

2. If special conditions exist which may warrant a variance in the above seed mixture, submit a written request to the Owner stating conditions and proposed variance. Permission will be given if, in the opinion of the Owner, the variance is warranted.

B. SEED FOR LAWNS: shall be the 'Drought and Salt Tolerant' custom seed mix, available at Charles C. Hart Seed Co., 304 Main St., Wethersfield, CT, tel: 860-529-2537, or approved equal. Apply seed at 8 pounds per 1,000 square feet minimum.

1. Mix contains: 30% Rhizing Moon Turftype Tall Fescue, 30% Nightcrawler Turf Type Tall Fescue, 20% Tumalo Kentucky Bluegrass, 20% Doubletime Perennial Ryegrass.

2.5 WOOD CELLULOSE FIBER MULCH

A. Mulch to cover hydroseeded areas with slopes flatter than ten to one (10:1) shall be fiber processed from whole wood chips and clean recycled newsprint in a 1:1 proportion manufactured specifically for standard hydraulic mulching equipment. Fiber shall not be produced from recycled material such as sawdust, paper, or cardboard.

1. Moisture content shall not exceed 10 percent, plus or minus 3 percent as defined by the pulp and paper industry standards. Fiber shall have a water holding capacity of not less than 900 grams water per 100 grams fiber.
2. The mulch shall be of such character that the fiber will be dispersed into a uniform slurry when mixed with water. It shall be nontoxic to plant life or animal life.
3. The mulch shall contain a non-petroleum based organic tackifier and a green dye to allow for easy visual metering during application but shall be non-injurious to plant growth.

2.6 WATER

A. WATER shall be free of substances harmful to plant growth. Contractor shall provide all labor and water required to establish turf and plantings. During the maintenance period the Contractor shall water as required to insure that a minimum of one inch of water per week is applied to all turf areas and plant beds and that soil moisture is maintained to a depth of two inches or greater at all times.

1. The Contractor shall furnish sufficient watering equipment to maintain required water levels in the soil.

PART 3 - INSTALLATION

3.1 PREPARATION OF SITE

A. Fully protect all trees and other site features to remain in the construction area during these operations. Remove existing lawn vegetation in areas of new seeded lawn and scarify surface of areas to receive topsoil by mechanical means using caution not to disturb or damage existing tree roots. Thoroughly till the subgrade to a depth of 6 inches by an approved method. Aerate in different directions such that each area receives at least 4 passes by the aerator. Break up resulting plugs with a power rake or other approved means.

B. After the subgrade of the areas required to be seeded or planted has been brought to the grades shown on the Drawings.

C. Before spreading topsoil, establish new finish grades and regrade subgrade as necessary to a true smooth slope parallel to and to the required depth below lawn areas and in new plant

beds. Care shall be taken to eliminate depressions and ridges. The top 3 inches shall be free from stones, rock or other foreign matter 2 inches or greater in dimension. Subgrade shall be inspected and approved by the Owner before the placing of topsoil.

D. Spread topsoil to meet finish grades smoothly and evenly. Provide sufficient grade stakes to insure correct line and grade of finished grade. Where no grades are shown, provide a smooth and continual grade between existing or fixed controls and elevations shown on the Drawings.

1. Thickness of topsoil in all new seeded areas shall be **6" minimum** measured after natural settlement and light rolling. Place topsoil only when it can be followed by seeding operations within a 1 week timeframe. Mechanically remove any weed growth prior to seeding. Do not permit weed growth to go to seed.

3.2 ADDITION OF SOIL AMENDMENTS

A. After the topsoil in lawn areas has been spread and graded, apply soil amendments at the rate recommended in the topsoil analysis. Apply limestone at least 5 days prior to application of fertilizer. Apply commercial fertilizer within 10 days of seeding or planting. In plant bed areas, organic compost shall be incorporated with topsoil prior to spreading in bed.

B. Thoroughly and evenly incorporate soil amendments into the soil to a depth of 4 inches by discing or other approved method. In areas inaccessible to power equipment, use hand tools. After the incorporation of soil amendments into the soil, fine grade the bed to remove all ridges and depressions, and clear the surface of all stones one inch or more in diameter and other debris. Remove excessive quantities of smaller stones as directed by the Owner.

C. Prior to seeding operations request that an inspection be made of the finished topsoil areas. Do not seed until Owner approves finish topsoil grade. Slope all lawn areas to drain. Correct finished surfaces to eliminate depressions holding water.

D. Seeding or planting may be done immediately thereafter provided the bed has remained in a good friable condition and has not become muddy or hard. If it has become hard, till to a friable condition. Water dry soil to a depth of 4 inches 48 hours prior to seeding or planting.

3.3 SCHEDULE FOR SEEDING AND PLANTING

A. The actual lawn seeding and planting operations shall be done only during periods within the season which are normal for such work as determined by weather conditions and by accepted practice in this locality. At the option of, and on the responsibility of, the Contractor seeding of lawns and planting may be done under unseasonable conditions, or out of season, without additional compensation subject to the approval at the time of work and methods of operation by the Owner. Lawn maintenance will be the same as for normal planting. Plant guarantee periods remain as specified. No frozen ground planting will be allowed.

B. Seeding and Planting shall be done within the following dates:

1. Trees and Shrubs	Spring:	April 1 to May 15
	Fall:	August 15 to October 30
2. Perennials and Grasses	Spring:	April 1 to May 15
	Fall:	September 1 to October 30
3. Seeded Lawns	Spring:	April 1 to May 15
	Fall:	August 15 to October 1

4.	Sodded Lawns	Spring:	April 1 to May 15
		Fall:	August 15 to October 1

3.4 SEEDING

A. Seed all fine graded topsoil areas as indicated on the Drawings within the limit of work not covered by paving and plant beds, and all areas disturbed by construction inside and outside the limit of work. All lawn areas disturbed outside the limit of seeding shall be prepared and seeded as specified herein at no additional cost.

1. To prevent loss of soil via water and wind erosion and to prevent the flow of sediment, fertilizer, and pesticides onto roadways, sidewalks, and into catch basins, seed loam areas within 5 Days of spreading the loam.

B. Seeding of all new seeded lawn areas shall be done using the Broadcast and/ or Hydroseeding Methods specified below. When delays in operations extend the work beyond the most favorable planting season for species designated or when conditions are such that satisfactory results are not likely to be obtained, halt work as directed and resume only when conditions are favorable or when approved alternate or corrective measures and procedures have been affected. No seeding shall be done when the ground is frozen, excessively wet or otherwise nontillable. If Contractor chooses to seed by a different method, he or she must present this alternative to the Owner's Representative for approval.

1. BROADCAST METHOD: Broadcast seed with a drop spreader evenly onto a firm seed bed. Lightly rake seed into the soil bed to increase seed to soil contact. 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. Do not broadcast seed when wind velocity exceeds 15 mph.

2. HYDROSEEDING METHOD: After seed mix has been broadcast, Hydroseeding can be started.

a. Hydroseed with wood cellulose fiber mulch at a rate of 92 pounds per 1,000 square feet or 4,000 pounds per acre.

b. For the hydroseeding process, a mobile tank with a capacity of at least 500 gallons shall be filled with water and the mixture noted above in the specified proportions. The resulting slurry shall be thoroughly mixed by means of positive agitation in the tank. Apply the slurry by a centrifugal pump using the hose application techniques from the mobile tank. Only hose application shall be permitted. At no time shall the mobile tank or tank truck be allowed onto the prepared hydroseed beds. The hose shall be equipped with a nozzle of a proper design to ensure even distribution of the hydroseeding slurry over the area to be hydroseeded and shall be operated by a person thoroughly familiar with this type of seeding operation.

c. Hydroseeding shall be a two-step process:

1. Step one shall consist of spreading 100 percent of the required seed uniformly over the prepared loam bed so that the seed comes into direct contact with the soil. To mark the progress of the hydroseeding operation the Contractor may add 10 percent of the wood cellulose fiber mulch to the slurry.
2. For slopes flatter than ten to one (10:1) step two shall consist of a separate application of wood cellulose fiber mulch immediately following the first step of hydroseeding noted above. Apply the wood cellulose fiber mulch at a rate of 2,000 pounds per acre.

A. In the event that the construction goes too late in the fall to allow for seeding of lawns in season, the Contractor will return in the spring to complete this work.

1. Any weed growth that has occurred on recently spread topsoil shall be removed by the Contractor prior to seeding. Seeding shall occur in season for Spring, with dates noted in this specification.

3.5 WOOD CELLULOSE FIBER MULCH

A. Mulch to cover hydroseeded areas with slopes flatter than ten to one (10:1) shall be fiber processed from whole wood chips and clean recycled newsprint in a 1:1 proportion manufactured specifically for standard hydraulic mulching equipment. Fiber shall not be produced from recycled material such as sawdust, paper, or cardboard.

B. Moisture content shall not exceed 10 percent, plus or minus 3 percent as defined by the pulp and paper industry standards. Fiber shall have a water holding capacity of not less than 900 grams water per 100 grams fiber.

C. The mulch shall be of such character that the fiber will be dispersed into a uniform slurry when mixed with water. It shall be nontoxic to plant life or animal life.

D. The mulch shall contain a non-petroleum based organic tackifier and a green dye to allow for easy visual metering during application but shall be non-injurious to plant growth.

3.6 LAWN MAINTENANCE AND PROTECTION

A. Maintenance and protection shall begin immediately upon completion of seeding operations and shall continue until acceptance or for at least 30 days or as much longer as necessary to establish a uniform stand of the specified grasses or until substantial completion, whichever is later with the following requirements.

1. In the event that lawn operations are completed too late in the Fall for adequate germination and/or growth of grass, maintenance shall continue into the following Spring.
2. Maintenance of lawn areas shall consist of keeping the grass in a healthy growing condition and shall include replacements, watering, weeding, cultivating, fertilizing, re-seeding as necessary to establish a uniform and knitted stand of the specified grasses and mowing.
3. During the maintenance period, any decline in the condition of seeded areas shall require immediate action to identify potential problems and to undertake corrective measures.
4. Reseed areas greater than one foot square which fail to show a uniform stand of grass. To be acceptable, a stand of grass shall have a uniform count of at least 100 plants per square foot.
5. In seeded areas, keep soil moist during germination period. After germination, supplement natural rainfall to produce a total of 2 inches per week. Water lawns not less than twice per week until acceptance.

B. WATERING shall be done in a manner that will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment.

1. The Contractor shall provide all labor and arrange for all watering necessary to establish an acceptable lawn. In seeded areas, Contractor shall keep soil continuously moist during the two to three week germination period. After germination, supplement natural rainfall to produce a total of 2 inches per week. Water lawns not less than twice per week until

acceptance or as often as necessary to maintain moist soil to a depth of at least 2 inches for newly seeded areas.

2. At no time shall a tank truck be allowed on the newly seeded lawns and plant beds.

C. PROTECTION

1. Protect new tree installations, plant beds and new seeded lawn areas at all times against trespassing and damage of all kinds for the duration of the maintenance period. If any plants become damaged or injured, treat or replace them as directed by the Owner's Representative at no additional cost to the Owner.

   a. Newly seeded lawn areas shall be protected by a 4-foot high barrier of Tenax 4 ft. x 50 ft. Saf-T-Sno HD Snow Fence, 4 ft. HDPE snow fence, or approved equal. Color shall be orange or red.

2. Provide additional temporary protection fences and barriers in other locations where deemed necessary.
3. Remove temporary protection devices at the completion of maintenance period.

D. MOWING

1. Do not attempt first mowing of lawn areas until newly seeded areas reach 2-1/2 inches in height. Do not remove more than 40% of the grass leaf in initial or subsequent mowings. Maintain grass at 2 inches in height. Remove grass clippings. Lawns shall receive at least 3 mowings before acceptance. Meadow and swale seeded areas shall have one mowing prior to end of the summer season.

3.7 INSPECTION AND ACCEPTANCE

A. At the end of the maintenance and protection period, submit a written request to the Owner to inspect all work for acceptance at least 10 calendar days before the anticipated date of inspection.

B. Until this portion of the work is finally accepted, the Contractor shall be required to repair and replace any lawn area that is defective or becomes damaged when, in the judgment of the Owner, such defects or damages are the result of poor workmanship or failure to meet the requirements of the specifications. The cost of necessary repairs or replacements shall be borne by the Contractor.

C. Acceptance of plant material by the Owner shall be for general conformance to the specified size, character and quality and shall not relieve the Contractor of responsibility for full conformance to the Contract Documents including correct species.

D. If a substantial number of plants are sickly or dead at the time of inspection, acceptance will not be granted, and the Contractor's responsibility for maintenance of all plants shall be extended until replacements are made. Replacements shall conform in all respects to the Specifications for new plants and shall be planted in the same manner.

E. The Owner will be responsible for the maintenance of new lawns and planting upon acceptance of the work and continuing through the guarantee period.

3.8 GUARANTEE PERIOD AND REPLACEMENTS

A. The guarantee period for plant material shall begin at the date of acceptance. All plant material shall be guaranteed by the Contractor, for a period of one year from the date of acceptance, to be in a good healthy and flourishing condition.

B. Lawn turf installed in the fall shall be guaranteed until the spring.

C. Replace without cost to the Owner, and as soon as weather permits, and within a specified planting period, all dead plants and all plants not in a vigorous, thriving condition, as determined by the Owner during and at the end of the guarantee period. Plants shall be free of dead or dying branches and branch tips, and shall bear foliage of a normal density, size and color. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this Specification. Make all necessary repairs due to plant replacements at no additional cost to the Owner.

D. The guarantee of all replacement plants shall extend for an additional period of one year from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of said extended guarantee period, the Owner may elect subsequent replacement or credit for each item.

E. Make periodic inspections as necessary, at no extra cost to the Owner, during the guarantee period to determine what changes, if any, should be made to the Owner's maintenance program. Submit in writing to the Owner and Owner any recommended changes.

3.9 FINAL INSPECTION AND ACCEPTANCE

A. At the end of the guarantee period, submit a written request to the Owner to inspect all guaranteed work for final acceptance at least 10 calendar days before the anticipated date for final inspection.

END OF SECTION