PROJECT MANUAL

for the

NEW GENERATOR INSTALLATION

Camp Hartell
Windsor Locks, Connecticut

PROJECT NO.

19MIL23702

Prepared By

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SECTION 02 10 00 – MAINTENANCE AND PROTECTION OF TRAFFIC

PART 1 - GENERAL

1.1 RELATED DOCUMENT:

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY:

A. Provide all labor, materials, necessary equipment and services to complete the work called for in this Section or as shown on the plans, including but not necessarily limited to the following:

1. All proposed construction signs and support posts required.
2. Barricades, traffic cones, warning lights and protective safety fence as required to establish roadway closing and to protect open trenches.
3. Protect pedestrian and vehicular traffic at all times on site. Provide flagmen as required.
4. Scheduling of activities and deliveries to minimize impact to traffic. Access to site for construction and deliveries should be coordinated with the owner.
5. Installation of impact attenuation systems if required.

B. Related Work: The following sections contain requirements that may apply to this section:

1. Division 31, Section 31 00 00 - “Earthwork”
2. Division 31, Section 31 10 00 - "Site Clearing”
3. Division 31, Section 31 11 00 - “Site Preparation and Demolition”
4. Division 32, Section 32 12 16 - "Bituminous Asphalt Concrete Paving.”

PART 2 – PRODUCTS

2.1 MATERIALS:

A. All materials, barricades, cones, etc. shall conform to the requirements described in the State of Connecticut Department of Transportation Form 817 and standard D.O.T. procedures.

PART 3 – EXECUTION

3.1 GENERAL:

A. Protect from vehicular and pedestrian traffic during all operations. Construct all barricades, cones, and safety fence as directed by the Owner's Representative.

B. All construction signs shall be constructed of aluminum with a minimum thickness of 0.100 mils. All colors shall be reflectorized and shall conform to State of Connecticut Department of Transportation Form 817, Section 12.20.

C. Sign supports - Wt./Ft. = 3 LB. and shall conform to Standard Connecticut sign mounting details.

D. Construction barricades shall conform to State of Connecticut Department of Transportation Form 817, Section 9.79. Traffic cones and drums shall conform to Sections 9.77 and 9.78 of Form 817.

E. The locating and or stockpiling of demolition material, construction material, construction equipment, machinery, supplies, vehicles, and materials, within any means of egress or any fire lane shall be PROHIBITED, no matter how temporary, without consultation with the Fire Marshal’s office.

F. The Fire Marshal's office reserves the right to require the posting of fire lanes upon the premises in accordance with State regulations.

G. Provide all signs, barricades, warning lights, and other appurtenances required to maintain traffic and access to parking areas.

End of Section 02 10 00

SECTION 03 21 00 – CONCRETE REINFORCING

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK:

A. Provide all labor, materials, necessary equipment and services to complete the concrete reinforcement work, including but not necessarily limited to the following:

1. Furnishing and placing of:

a. Deformed bar reinforcing.
b. Welded wire fabric.
c. Chairs, supports, ties and miscellaneous hardware for holding reinforcing in place.

1.2 SUBMITTALS:

A. Shop drawings for all reinforcing steel shall be submitted. Drawings shall show bending diagrams, splicing and laps of bars, shapes, dimensions, details of bar reinforcing, and accessories. Shop drawings must be reviewed by the Engineer before proceeding with the work.

B. Review of Shop Drawings will only be for sizes and spacing of reinforcement and will not cover detailed fabricating dimensions.

C. All concrete walls shall be drawn in elevation at a minimum of one quarter inch per foot scale showing all wall reinforcing and openings.

D. Structural drawings or sections shall not be reproduced on shop drawings.

1.3 QUALITY ASSURANCE:

A. All work of this section shall be provided in accordance with the latest edition of the following standards that are considered to be a part of this specification the same as if fully set forth herein.

1. Building Code Requirements for Reinforced Concrete (ACI 318).
2. Specifications for Structural Concrete for Buildings (ACI 301).
3. 2018 State of Connecticut Building Code

PART 2 – PRODUCTS

2.1 MATERIALS

A. Material shall conform to the latest requirements of the ASTM Standard Specifications serial designated below and manufactured in the United States.

1. A615 Grade 60 for all bar reinforcing.
2. A185 for Welded Steel Wire Fabric for Concrete Reinforcement.

2.2 FABRICATION

A. Reinforcement shall be accurately formed in the shapes and dimensions shown on the drawings and approved schedules.
B. Reinforcement shall be shop fabricated. No field bending or re-bending or cutting will be permitted.
C. All material shall bear mill identification symbol and be stored so that different sizes may be identified.
D. Wire mesh reinforcing shall be delivered in sheets.
E. All reinforcing shall be epoxy coated.

2.3 INSTALLATION

A. All reinforcement shall be installed in accordance with ACI 318, ACI 301 and the Connecticut Building Code.
B. Reinforcing shall be delivered and stored at the site in a manner that will protect material from damage.
C. When required or permitted all welding of reinforcing bars shall conform to AWS D1.4. Welding electrode used shall be compatible with Grade 60 reinforcing and the base metal specified.
D. When required or permitted, mechanical connections shall be installed in accordance with the splice device manufacturer's recommendations.

End of Section 03 21 00

SECTION 03 30 00 – CAST IN PLACE CONCRETE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to this section.
B. The latest edition of referenced requirements shall apply.

1.2 DESCRIPTION OF WORK:

A. Provide all labor, materials, necessary equipment and services to complete the concrete formwork and cast-in-place concrete work as indicated on the drawings, specified herein or both.

1. Forms for footings, walls, slabs, and any other concrete as shown on the drawings, or specified herein.
2. Furnishing, placing and finishing of cast-in-place concrete for footings, walls, slabs and any other concrete as shown on the drawings or specified herein.
3. Placing of cast-in-items such as anchor bolts, angles, clips, anchors, and the like furnished under this and other sections.

B. Related Work: The following sections contain requirements that may apply to this section:

1. Division 2 Section "Earth Moving".
2. Division 3 Section "Concrete Reinforcement".

1.3 SUBMITTALS:

A. Submit sand and coarse aggregate source and physical properties.

B. Submit laboratories trial mix designs proposed in accordance with Method 1, ACI 301 or one copy each of 30 consecutive test results and the mix design used from a record of past performance in accordance with ACI 301, Method 2.

C. The contractor shall submit the mix designs for approval at least ten (10) days before commencing any concrete operations.
D. Submit catalog cuts and/or appropriate descriptive material and test results for the following:

1. Curing and hardening compounds
2. Air entrapment admixtures.

E. Submit procedures for protecting concrete during placement and curing if required.

1.4 QUALITY ASSURANCE:

A. All work of this section shall be provided in accordance with the latest edition of the following standards which are considered to be a part of this specification the same as if fully set forth herein:

1. Specifications for Structural Concrete for Buildings ACI 301.
2. Building Code Requirements for Reinforced Concrete ACI 318.
3. 2018 State of Connecticut Building Code.

B. It is the intent of this specification to secure for every part of the work, concrete of homogeneous nature which, when hardened, will have the required strength, resistance to weathering, and such other qualities as the type of structure or its location may require.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Cement shall be Portland Cement, Type I or II conforming to ASTM C150. Cement used in the work shall correspond to that upon which the selection of concrete proportions was based.

B. Hi-early cement shall be used only with prior approval from the Engineer.
C. Concrete admixtures: provide admixtures produced and serviced by established, reputable manufacturer's recommendations.

1. Air-entraining admixtures shall conform to ASTM C260. Water-reducing, set-controlling admixture shall conform to ASTM C494, Type A (water-reducing), Type D (water-reducing and retarding) and Type E (water-reducing, accelerating), Type F or G (high range water-reducing, superplasticizer).
2. Admixtures containing calcium chloride or Thiocyanate shall not be used.
3. Field Service: a qualified concrete technician employed by the manufacturer shall be available to assist in proportioning concrete materials for optimum use,

to advise on proper use of the admixture and adjustment of concrete mix proportions to meet job site and climatic conditions.

D. Aggregate:

1. Fine aggregate shall conform to ASTM C33 and be clean, sharp, natural sand, free from loam, clay lumps, or other deleterious substance, within allowable standards.
2. Coarse aggregate for normal weight concrete shall conform to ASTM C33 for normal weight concrete. All aggregate shall be clean, uncoated, graded aggregate, containing no clay, mud, loam, or foreign matter.

E. Water shall be fresh, clean, and drinkable.

F. Curing materials for walls shall conform to the requirement of ASTM C309 "Standard Specifications for Liquid Membrane Forming Compounds for Curing Concrete."

1. Materials shall provide water retention not exceeding loss of .055 gm/sq. cm. when used at a coverage of 450 sq. ft. per gallon.

G. Expansion Joint filler:

1. ASTM D1751.
2. Install in sizes as shown on the drawings in accordance with manufacturer's recommendations.

H. Curing blankets for all flatwork.

I. Water Vapor Transmission Inhibiting Admixture. See Specification Section 03 05 10.

PART 3 – EXECUTION

3.1 PROPORTIONING OF CONCRETE:

A. Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, water, a water-reducing admixture, and an air-entraining admixture.

B. Proportions of ingredients shall produce concrete which will work readily into corners and angles of forms, and bond to reinforcement without segregation or excessive bleed water forming on the surface. Proportioning of materials shall be in accordance with ACI 211.1.

C. Required Average Strength: Determinations of required average strength (f'c) above specified strength shall be in accordance with ACI 318 and evaluations of compressive strength results of field concrete shall be in accordance with ACI 214.

3.2 REQUIRED CONCRETE QUALITIES:

A. Specified Compressive Strength at 28 days shall be 4,500 psi for all concrete see below for additional information.

1. All concrete: (Normal weight with air)

B. Concrete subject to exposure shall be air-entrained. Total air content required (air-entrained and entrapped air) shall be 5% +/- 1% for 3/4" coarse aggregate.

C. Concrete shall be proportioned and produced to have a maximum slump of 4 inches unless a superplasticizer is used. A maximum slump of 6" shall be allowed if a superplasticizer is used. Consolidation shall be by means of vibrators.

D. Maximum size of coarse aggregate shall not exceed 3/4".

E. Concrete shall be adjusted to produce the required rate of hardening for varied climatic and job site conditions.

1. Under 50° F. ambient temperature - Accelerate (approval in writing required from the Engineer) (Type E admixture - ASTM C494).
2. Over 80° F. ambient temperature - Retard (Type D admixture ASTM C494).
3. Between 50° F. and 80° F. - Normal Rate of Hardening (Type A admixture - ASTM C494).

3.3 FORMWORK PREPARATION:

A. Forms shall be used to confine and shape concrete to required dimensions. Forms shall have sufficient strength to withstand forces from placement and vibration of the concrete, and sufficient rigidity to maintain specified tolerances.

B. Design, engineering, and construction of the formwork shall be the responsibility of the Contractor.

C. Work shall be designed for loads, lateral pressure and allowable stresses in accordance with ACI 347, "Recommended Practice for Concrete Formwork."

D. All tolerances, preparation of form surfaces, removal of forms etc. shall be in accordance with chapter 4 of ACI 301.

E. Construction joints shall be located only where approved by the Engineer.

3.4 CONCRETE PLACEMENT:

A. Formwork shall have been completed and all snow, ice, water, and debris removed from within forms.

B. Expansion joint material, anchors and all embedded items shall have been positioned.

C. Subgrades shall be sprinkled sufficiently to eliminate water loss from the concrete.

D. Concrete shall not be placed on frozen ground.

E. Concrete shall be ready-mixed, batched, mixed and transported in accordance with ASTM C94.

F. Preparations: Contractor shall provide access for delivery and provide sufficient equipment and manpower to rapidly place all concrete.

G. Conveying: Concrete shall be handled from mixer to final deposit rapidly by methods which will prevent segregation or loss of ingredients to maintain required quality of concrete. It shall be placed in the forms or on grade as near as practicable to its final position and shall be prohibited from free falling more than 4 feet.

H. Concrete shall be deposited continuously; when continuous placement is not possible, construction joints shall be located as approved by the Engineer. Concrete shall be placed as nearly as possible to its final position. Avoid re-handling or flowing.

I. Cold Weather: When ambient temperatures are below 40°F, or at 45°F and falling, the requirements of ACI 306R “Recommended Practice for Cold Weather Concreting” shall be followed.

1. Temperature of concrete delivered at the job site shall comply with the requirements of ACI 306R, "Cold Weather Concreting."

2. Concrete temperature shall be maintained during cold weather for the recommended period of time specified in Table 1.4.2 in A.C.I. 306R.

3. Special attention shall be given to the corners and edges of concrete during cold weather to prevent damage.
4. Provisions shall be made to retain heat by using insulating blankets or by an outside heat source.

J. Hot Weather: When ambient temperatures are at or above 75°F or at 70°F and rising, the requirements of ACI 305R "Recommended Practice for Hot Weather Concreting" shall be followed.

1. The temperature of concrete delivered at the job site shall comply with the requirements of ACI 305R,

K. Curing and Protection: Immediately following placement, concrete shall be protected from premature drying, hot and cold temperatures, rain, flowing water and mechanical injury. Materials and method of curing shall be approved by the Engineer. THE USE OF CURING COMPOUNDS ON FLATWORK WILL NOT BE ACCEPTED. ALL FLAT WORK SHALL BE WET CURED A MINIMUM OF 7 DAYS.

L. Vertical and Overhead Surface Finishes:

1. Interior and exterior exposed areas to be painted: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by Engineer, and by rubbing lightly with a fine abrasive stone or hone. Use ample water during rubbing without working up a lather of mortar or changing texture of concrete.

M. Slab Finishes:

1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to Engineer and floor consultant for evaluation and recommendations for subsequent placements.

2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike off, unless the Engineer determines method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or

laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates un-shored structural steel deflections to other than a level profile.

3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day.

4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike off. Repeat strike off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.

5. Immediately following screeding, and before any bleed water appears, use a 10-foot wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.

6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 1/4-inch indentation.

7. Broom Finish: Finish exterior slabs with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by Resident Engineer from sample panel.

N. Repair of Surface Defects: All surface defects shall be repaired immediately after form removal according to Chapter 9 of the ACI 301.

O. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content for more than 1-1/2 hours.

3.5 TESTING AND INSPECTION:

A. Materials and operations shall be tested and inspected as work progresses. Failure to detect defective work shall not prevent rejections when defect is discovered.

B. The following testing services shall be performed by the testing laboratory selected and paid for by the Owner:

1. Mold and cure four specimens from each sample of concrete.

2. Test specimens in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders," ASTM C39. Two specimens shall be tested at 28 days for acceptance and one shall be tested at 7 days for information. An additional cylinder shall be made as an extra in case a 56-day break is required.

3. Make one strength test for each concrete placement (One test consists of 4 cylinders.)

4. Determine slump, air content and temperature for each strength test and whenever consistency of concrete appears to vary.

5. All sampling of pumped concrete shall be done at the discharge end of the pump lines.

6. Testing laboratory to provide for measurements of slab finish as required by Engineer and as described in Section 3.4, item M.11.a.

C. To facilitate testing and inspection, the contractor shall:

1. Furnish necessary labor to assist testing agency in obtaining and handling samples at the job site.

D. Owner agrees to pay for the above tests with the exception of work that is found to be defective. Subsequent tests shall be taken and paid for by the contractor.

E. During cold weather additional weather information shall be recorded including temperatures at several points within the enclosure and on the concrete surface, corners, and edges to show range of values. See Chapter 9 of A.C.I. 306R.

End of Section 03 30 00

SECTION 26 00 00 – GENERAL ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including Division 0, Contract Requirements, and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and /or Subcontractor who performs this work. Note also all addenda.

B. The requirements in Section 26 00 00 shall govern the work under all Sections of Division 26.

1.2 SCOPE OF WORK:

A. Scope of work consists of installation of materials to be furnished under these Specifications and without limiting generality thereof consists of furnishing labor, materials, equipment, hoisting, plant, transportation, rigging, staging, appurtenances, and services necessary and/or incidental to properly complete all electrical work as shown on drawings, as described in the Specifications or as reasonably inferred from either as being required in opinion of the Engineer.

B. Work Included: Provide complete electrical services where shown on the drawings, as specified herein and as needed for a complete and proper installation including but not necessarily limited to:

1. Demolition.
2. Temporary power.
3. Standby power generator.
4. Automatic transfer switch.
5. Feeders.
6. Branch circuit wiring.
7. Wiring devices – receptacles and switches.
8. Light fixture.
9. Concrete pad for generator.

1.3 SITE CONDITIONS:

A. Prior to submitting bid, visit the site and identify existing conditions and difficulties that will affect work called for by the Contract Documents.

B. No compensation will be granted for additional work caused by unfamiliarity with site conditions that are visible or readily construed by experienced observers. Include in the bid amount all demolition work required.

C. The Contractor shall verify and obtain all necessary dimensions at the site.

1.4 DEFINITIONS:

A. Furnish: The word "furnish" is used to mean "supply and deliver the referenced item to the project site, ready for unloading, unpacking, assembly, and installation".

B. Install: The word "install" is used to describe operations at the project site involving the referenced item including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations".

C. Normally Occupied: The words "normally occupied" are used to mean "all rooms within a building except for crawlspaces, underground tunnels, attic spaces, mechanical rooms, telephone rooms, data distribution rooms, and electrical rooms".

D. Or Approved Equal: The words "or approved equal" are used to mean "any product which in the opinion of the Engineer is essentially equal in quality, size, arrangement, appearance, construction, and performance to that product specified or shown on the drawings".

E. Provide: The word "provide" means "to furnish and install the referenced item, complete and ready for the intended use".

F. Remove: The word "remove" means "to disconnect from its present position, remove from the project site, and to dispose of in a legal manner".

1.5 QUALITY ASSURANCE:

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of the Contract Documents.

B. Codes and Regulations:

1. In addition to complying with the specified requirements, comply with all

Federal, State and Local Codes wherever applicable including the following: 2018 Connecticut State Building Code, 2015 IBC, 2018 Connecticut Fire Safety Code , 2015 International Fire Code, 2013 NFPA 72 National Fire Alarm Code, 2017 NFPA 70 National Electrical Code, 2010 NFPA 110 Standard for Emergency and Standby Power Systems, 2015 International Energy Conservation Code, ICC/ANSI A117.1-2009 Accessible and Usable Buildings and Facilities, and ADA.

2. Comply with the requirements of the Local Authority Having Jurisdiction.
3. Materials and equipment shall be UL listed where standard has been established.
4. Perform tests required by specifications, Engineer's instructions, laws, ordinances or public authorities, approvals, and give Owner timely notice. Notify the Owner of dates for inspection by other authorities.
5. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern.
6. Reference made to codes and standards shall be interpreted as minimum requirements. Provide and perform work in excess of codes and standards as indicated by drawings or specifications.

C. Prior to bidding, the Contractor shall give written notice to the Engineer of any materials, equipment, or apparatus believed in the opinion of said Contractor, to be inadequate or unsuitable for the installation, or in violation of laws, ordinances, rules, or regulations of authorities having jurisdiction. The Contractor shall also give written notice to the Engineer of any items, materials, equipment, or work believed in the opinion of said Contractor, to be omitted from the Contract Documents. In the absence of such written notice, it is mutually agreed that Contractor has included the cost of all required items in his bid and that he will be responsible for approved satisfactory functioning of systems without further compensation.

1.6 SUBMITTALS:

A. Product data: after the Contractor has received the Owner’s Notice to Proceed, submit an electronic copy in PDF format of the following:

1. Materials list of all items proposed to be provided.

2. Manufacturer’s specifications, catalog cuts, performance curves, electrical characteristics, wiring diagrams, equipment dimensions and weights, and other data for each item proposed to be provided as needed to prove compliance with the specified requirements.

3. Shop drawings and other data as required to indicate method of installing and attaching equipment.

B. Provide a title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the title block.

1. Include the following information for processing and recording action taken:
   a. Project name, location, and address
   b. Date
   c. Name and address of Engineer
   d. Name and address of Contractor
   e. Name and address of Sub-Contractor
   f. Name and address of supplier(s)
   g. Name of manufacturer(s)
   h. Number and title of appropriate Specification section.

C. Data sheets and catalog cuts, etc. contained in submittals shall be clearly marked indicating specific service or application for which material or equipment is to be used. Data of a general nature and not clearly defining the service or application for which the proposed item is to be used will not be accepted.

D. Submit for review complete diagrams of systems prepared by equipment manufacturer showing connections and equipment. Standard wiring diagrams shall be modified where necessary to specific system.

E. Prior to forwarding submittals and shop drawings for review by the Engineer, the Contractor shall thoroughly check each submittal, reject those not conforming to the specifications, and indicate by his signature that the submittals in his opinion meet the contract requirements.

F. Intent of Shop Drawings and product data review is to check for capacity, rating and certain construction features, ensure that work meets requirements of Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction, and for coordination of work between trades.

G. Submittal review shall not diminish responsibility under this contract for dimensional coordination, quantities, installation, piping, supports, access, service and errors, nor for deviations from requirements of contract documents. Noting errors while overlooking others will not excuse proceeding in error. Requirements of contract documents are not limited, waived, nor superseded by shop drawing review.

H. Equipment variations: Where no specific make or material, apparatus or appliance is mentioned in the Contract Documents, any first class product made by a reputable

manufacturer may be used, providing it conforms to the requirements of these specifications and meets the approval of the Engineer.

I. Equipment alternates, substitutions, and deviations:

1. Wherever more than one manufacturer is mentioned in the specifications or on the drawings, any of those named shall be considered equally acceptable to that on upon which design was based, and providing all aspects of the specification are met insofar as quality, construction, performance, space requirements, noise levels and special accessories or materials, any of those named may be included in Contractor's bid.
2. Bidders wishing to obtain approval on brands other than those specified by name shall submit their request to the Engineer not less than ten (10) business days before the date fixed for opening of bids. Approval by the Engineer will be in the form of an Addendum to the specifications issued to all prospective bidders, indicating that the additional brand or brands are approved as equal to those specified so far as the requirements of the project are concerned.
3. Alternate equipment to that specified or shown on the drawings, as proposed to be provided by the contractor, must be essentially equal in quality, size, construction, and performance to that item specified or shown on the drawings.
4. Submittals for alternate equipment shall list all deviations and differences from the specified equipment. Failure to submit this list will result in rejection of the submittal.
   Any deviations and differences not listed but discovered after installation shall be rectified as directed by the Engineer at the Contractor’s cost.
5. Furnish samples of alternate equipment proposed to be provided when so requested by the Engineer.
6. Where the Contractor proposes to use an item of equipment which differs from that upon which design was based, which requires any redesign of the structure, partitions, foundations, piping, wiring or of any other part of Mechanical, Electrical or Architectural Layout, all such redesign, new drawings or detailing required shall be prepared by Contractor at his own expense for approval of the Engineer.
7. Where approved substitutions or deviations require a different quantity, size or arrangement of structural supports, wiring, conduit, piping, ductwork, and equipment from that upon which design was based, all additional items required by the systems shall, with the approval of the Engineer, be furnished by Contractor at no additional cost to Owner.

J. Allow sufficient time so that the delivery and installation of equipment will not be delayed as a result of the time required to review, process and transmit submittals, including resubmittals. Failure by the Contractor to transmit submittals to the Architect and Engineer in ample time for review and processing shall not entitle him

to an extension of the Contract Time and no claim for an extension of time by reason of such default will be allowed.

K. Submittals, shop drawings, and samples will be reviewed with reasonable promptness and will be stamped indicating appropriate action as follows:

1. "No Exceptions Taken" means that fabrication, manufacture, or construction may proceed providing submittal complies with contract documents.

2. "Amend as Noted" means that fabrication, manufacture, or construction may proceed, providing the submittal complies with Engineer's notations and contract documents.

3. "Resubmit" means that submittal, or equipment proposed to be provided, does not comply fully with the contract documents and that fabrication, manufacture, or construction shall not proceed. Resubmit in accordance with the Engineer's notations and contract documents.

4. "Rejected" means that submittal does not comply with contract documents, or that equipment proposed to be provided does not comply with the specified requirements or is not equal or better in quality and performance than that item specified. Fabrication, manufacture, or construction shall not proceed. Resubmit in accordance with the contract documents and specified requirements.

L. If material or equipment is installed prior to review, or without review, it shall be removed and replaced at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment is not in compliance with the Contract Documents.

1.7 RECORD DRAWINGS:

A. Maintain a clean, undamaged set of black line white-prints of Contract Drawings and Shop Drawings at the job site. Protect record drawings from deterioration and loss in a secure location. Provide access to record drawings for reference during normal working hours by the Owner, Engineer, and Authority Having Jurisdiction.

B. As work progresses mark the record drawings to show the actual installation where the installation varies from the work as originally shown, whether resulting from Addenda, Change Order, approved submittals, or changes made due to field conditions. Mark whichever drawing is most appropriate for showing conditions fully and accurately. Where shop drawings are used, record a cross reference at the corresponding location on the Contract Drawings. Give particular attention to items

concealed within the structure or buried below grade.

1. Mark record sets with colored erasable pencils: using separate colors to distinguish between different systems.
2. Include dimensioned locations of conduit runs buried below floor slabs and buried beyond the building footprint.
3. Note related change order numbers where applicable.

C. At the completion of work prepare a new set of black line white-print Record Drawings, of work as actually installed, incorporating addenda, changes made due to approved submittals, change order work, field changes, and added data, all as shown on the marked-up record drawings maintained at the site. Date the set and clearly mark it as "Record Drawings".

D. Furnish two sets of the Record Drawings to the Engineer for review and transmission to the Owner.

1.8 OPERATING AND MAINTENANCE MANUALS:

A. Upon completion of the work of this Contract, deliver to the Engineer four (4) copies of an Operation and Maintenance (O & M) Manual. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl covered binders, with pocket folders for folded sheet information. Include a separate section for each system or sub-system. Sections shall be separated by heavy plastic dividers with tabs that identify the material in each section. Place a permanent label or title block on each binder for identification.

1. Include the following information on the label:

    a. O & M Manual for: Enfield Armory – New Generator
    b. Date
    c. Name and address of Engineer
    d. Name and address of Contractor
    e. Name and address of Sub-Contractor

B. Provide the following in each manual:

1. Table of Contents
2. Listing of all service agents with addresses and telephone numbers
3. Description of systems operation
4. Emergency instructions for equipment and/or systems where appropriate

5. Wiring diagrams and piping diagrams specific to systems installed.
6. Manufacturers' operating and maintenance instructions for each piece of equipment installed
7. Inspection procedures
8. Spare parts list
9. Copies of all panelboard circuit indexes.
10. Copies of measurements taken where specified elsewhere in the Contract Documents
11. Copies of all warranties and guarantees.
12. Copies of submittals and shop drawings.

1.9 GUARANTEE AND WARRANTIES:

A. Obtain in Owner's name written equipment and material warranties offered in manufacturer's published product data without exclusion or limitation.

B. Guarantee work of this Contract in writing for not less than eighteen (18) months from date of Substantial Completion. Repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to Owner's satisfaction and correct damage caused in making necessary repairs and replacements under guarantee within contract price. Provide extended equipment warranties where specified.

C. Replace material or equipment that requires excessive service during guarantee period, as defined and as directed by the Engineer.

D. Submit guarantee to the Owner before final payment.

1.10 LAWS, ORDINANCES, PERMITS, AND FEES:

A. Give all necessary notices, obtain all permits and pay all taxes, fees and other costs in connection with the work; file all necessary plans, prepare all documents and obtain all necessary approvals of all Regulation Authorities; obtain all required Certificates of Occupancy and/or Inspections required for the work and deliver same to the Owner before requests for acceptance and final payment for the work.

B. Include in the work, without extra cost to the Owner, all labor, materials, services, apparatus, drawings (in addition to Contract Documents and Drawings) required to comply with all applicable laws, ordinances, rules and regulations.

1.11 CORRELATION OF DRAWINGS AND SPECIFICATIONS

A. In general, the Specifications will describe the “quality” of the work and the drawings The “extent” of the work. The drawings and specifications are cooperative and supplementary; however, and each item of the work is not necessarily mentioned in both the drawings and specifications. All work necessary to complete the project, so described, is to be included in this contract.

B. In case of disagreement between drawings and specifications, or within either document itself, the better quality or greater quantity of work shall be estimated and the matter shall be drawn to the Engineer's attention for decision and/or adjustment. Any work done by any Contractor without consulting the Engineer, when the same requires a decision and/or adjustment, shall be done at the Contractor’s risk.

C. Drawings are diagrammatic and indicate general arrangement of systems and work included in Contract. Information and components shown on diagrams but not on plans, and vice versa, shall apply or shall be provided as though expressly required on both. It is not intended that every fitting or component be specified or shown on drawings; however, Contract Documents require provision of all components and materials necessary for a complete and operational installation, whether or not indicated or specified.

D. Do not scale drawings. Scale indicated on drawings is for establishing reference points only. Actual field conditions shall govern all dimensions. The Contractor shall verify all dimensions at the project site.

E. In all cases where the Contract Documents refer to equipment or apparatus in singular number, it is intended that such reference include as many such items that are required to complete the work.

1.12 ELECTRICAL VOLTAGES:

A. The electrical service to the buildings is 120/208V, 3 phase, 4 wire.

B. All equipment shall be suitable for this electrical supply. It is the responsibility of the Contractor to study the electrical drawings to determine the supply for any particular piece of equipment. If equipment requires other electrical characteristics (voltage and phase) than that supplied and shown on the electrical drawings, transformers and wiring shall be provided with that equipment at no extra cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP:

A. Provide only materials that are new and of type and quality specified. Where Underwriters' Laboratories, Inc. have established standards for such materials, provide only materials bearing the UL label.

B. Provide accessories, materials and equipment necessary to make installation complete in every detail, and to conform to manufacturers' latest installation instructions, under this Contract whether or not specifically shown on drawings or specified herein.

C. All component parts of each item of equipment shall bear the manufacturers' nameplate, giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc. in order to facilitate maintenance or replacement. Contractors or Distributors nameplates shall not be fixed to items of equipment and are not an acceptable alternate to the manufacturer's nameplate data.

D. No materials or equipment used shall be discontinued or about to be discontinued items.

E. The Engineer shall have the right to reject any part of the work in case the material or workmanship is not of satisfactory quality. Any work or material deemed unacceptable by the Engineer shall be removed and replaced with acceptable work and material as defined by the Engineer, and at no additional expense to the Owner.

2.2 PROTECTION:

A. Work performed by the Contractor shall include protecting the work and materials of all other Contractors from damage by work or workmen, and shall include making good any and all damage thus caused.

B. The Contractor shall be responsible for work and equipment until finally inspected, tested and accepted. Protect work against vandalism, theft, weather, injury or damage, and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with approved covers, caps or plugs during construction to exclude dust, dirt, moisture, plaster, mortar, or general construction debris. Note - duct tape is not an acceptable means of protecting open conduit and pipe ends.

C. If so specified, work may include receiving, unloading, uncrating, storing, protecting,

setting in place and completely connecting any motor starters and/or control equipment having mechanical/electrical service connections which may be furnished by Owner or furnished by others.

D. Work shall include exercising special care in handling and protecting equipment and fixtures. Any equipment and fixtures which are missing, lost, stolen, or damaged by reason of the Contractor's failure to provide adequate protection shall be replaced by that Contractor at no additional cost to the Owner.

2.3 TEMPORARY FACILITIES:

A. Provide temporary power and lighting as required for the performance of the work of this Contract.

B. Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. All materials shall be suitable for the service intended.

C. Maintain temporary services and facilities in a neat and clean manner. Operate in a safe and efficient manner. Do not allow hazardous, dangerous, or unsanitary conditions to develop or persist on site.

D. Do not overload temporary facilities, or permit them to interfere with progress of the work.

E. Scaffolding and other temporary construction shall be rigidly built in accordance with Local, State, and Federal regulations.

F. Remove each temporary facility when no longer needed, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete and/or restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces, and replace construction that can not be repaired to the satisfaction of the Owner.

2.4 SCAFFOLDING, RIGGING, HOISTING:

A. Work shall include all scaffolding, rigging, hoisting and services necessary for delivery and erection of equipment into or onto the site and/or building. Remove all scaffolding, rigging, and hoisting equipment from the site when no longer needed.

2.5 CUTTING AND PATCHING:

A. Provide cutting and patching as required for all electrical work performed under this contract. Patching shall match existing adjacent surface.

2.6 SLEEVES AND OPENINGS:

A. The Electrical Contractor shall provide all necessary sleeves and openings as required to permit the installation of the electrical systems.

2.7 BASES AND SUPPORTS:

A. Provide all necessary supports, rails, framing, bases, and piers required for the installation of equipment provided under this contract.

B. Unless otherwise shown, all equipment shall be securely attached to the building structure in an acceptable manner. Attachments shall be of a strong and durable nature; any attachments that are insufficient in the opinion of the Engineer shall be replaced as directed at no additional cost to the Owner.

2.8 SEISMIC RESTRAINTS:

A. Provide seismic restraints for all electrical system components in accordance with the Connecticut State Building Code.

2.9 SLEEVES, INSERTS AND ANCHOR BOLTS:

A. The Contractor shall provide and shall be held responsible for the location and position of all sleeves, inserts, and anchor bolts required by his work. Failure to do so, which requires cutting and patching of finished work, shall be done at no additional cost to the Owner.

2.10 FIRE STOPPING:

A. Provide fire stopping for electrical penetrations through rated assemblies.

2.11 LUBRICATION:

A. All equipment installed under this contract having moving parts shall and requiring lubrication shall be properly lubricated according to the manufacturer’s instructions prior to operation and testing. Any such equipment discovered to have been operated prior to lubrication by the Contractor shall be subject to rejection and replacement at no

additional cost to the Owner.

2.12 OTHER MATERIALS:

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

B. Provide miscellaneous hardware and support accessories, including channels, support rods, nuts, bolts, screws, and other such items, with galvanized or cadmium plated finish, or other approved rust inhibiting coatings.

PART 3 - EXECUTION

3.1 GENERAL:

A. Unless specifically noted or shown otherwise, install all equipment and material specified herein or shown on drawings whether or not specifically itemized herein.

3.2 SURFACE CONDITIONS:

A. Examine the areas and conditions under which work of this Contract will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.3 DEMOLITION AND REMOVALS:

A. Existing electrical systems, equipment, and wiring shall be demolished and removed as shown on the drawings and as specified herein.

B. The demolition drawings are an accommodation to the Contractors to show general intent of the scope of the demolition work. However, it is incumbent on the various Contractors to visit the job prior to bidding to determine the exact amount of demolition work he is responsible for. If clarification is not requested prior to bidding on any item, it is assumed the scope is understood and all required demolition work will be performed whether or not same is shown on the drawings.

C. Any asbestos removal work required shall be done under a separate contract.

D. Disconnect, remove, and/or relocate existing electrical work as noted on the plans, as required for the performance of the work of this contract, and as required for

coordination of the work between trades.

E. Remove all demolition material from the job site unless the owner requests to retain any such material for his own use. Any material that is requested by the Owner to be retained shall be delivered to the Owner's designated storage area on site.

3.4 PREPARATION:

A. Coordinate:

1. Coordinate as necessary with other trades to assure proper and adequate provisions in the work of those trades for interface with the work of this Contract. Each Contractor shall furnish all information necessary to permit work of other trades to be installed in a satisfactory manner.

2. Coordinate delivery of equipment to project prior to installation. Any equipment stored for an extended period of time prior to installation may be subject to rejection by the Engineer.

3. Coordinate the installation of items with the schedule for work of other trades to prevent unnecessary delays in the total work.

4. Where electrical equipment is shown in conflict with locations of structural members or other equipment, provide required supports, offsets, bends, or tees as required to clear the encroachment.

5. No conduit, cable(s), boxes, etc., shall be installed until the entire run has been checked for clearances and the work has been coordinated between all the trades. Each tradesman shall be responsible for taking his own field measurements and maintaining proper clearance from the Owner's equipment and the work of other trades, and for coordinating his work with that of other Contractors. Furnish all necessary information, dimensions, templates, etc. in order that a properly coordinated job will result.

6. Prior to roughing, the contractor shall obtain exact electrical equipment, fixture, and device locations from the Owner. Equipment, fixture, and device locations shown on the drawings are to be used for general reference only. Roughing of equipment, fixtures, and devices shall not proceed until the exact locations, heights, and orientations of same have been agreed upon with the Architect and Owner.

7. If due to lack of coordination and foresight by the Contractor, equipment must be relocated or extra work performed, all costs shall be the responsibility of the

Contractor and may not be passed through to the Owner.

B. Unload equipment and materials delivered to the site. Pay cost for rigging, hoisting, lowering and moving electrical equipment on site, in building, or on roof. During construction provide protection against moisture, dust accumulation, and physical damage of equipment. Provide temporary heaters within units as required to evaporate excessive moisture and provide ventilation as required.

C. Certain present building clearances are available for handling equipment. All equipment shall be delivered knocked down as required to clear space limitations on site and within the building.

D. Unless noted otherwise the Contractor shall set all equipment level, plumb, and secure prior to making connections to other equipment or systems.

E. Data indicated on the drawings and in these Specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels and other conditions will be governed by actual construction and the drawings and specifications should be used only for guidance in such regard.

F. Verify all measurements at the building. No extra compensation will be allowed because of differences between work shown on the drawings and actual measurements at the site of construction.

G. The drawings are diagrammatic, but are required to be followed as closely as actual construction and work of other trades will permit. Where deviations are required to conform to actual construction and the work of other trades, make such deviations without additional cost to the Owner.

3.5 ACCESSIBILITY:

A. Locate all equipment which must be serviced, operated or maintained, in fully accessible positions. Provide access panels as required for equipment access.

B. Failure by the Contractor to locate equipment and arrange the installation to allow for adequate access and clearance for maintenance and servicing shall result in rejection of the installation and the disassembly, relocation and re-assembly of the installation shall be done by the Contractor at no additional cost to the Owner.

3.6 CLEANING AND PROTECTING PIPING, CONDUITS AND EQUIPMENT:

A. Thoroughly clean all piping, conduit, and equipment of all foreign substances inside and

out before installation.

B. Plug open pipe and conduit ends during construction with approved plugs or caps to exclude dust, moisture, plaster or mortar etc. Note - using duct tape to cover conduit and pipe ends is not an acceptable means of excluding construction debris and may result in rejection of the installation with remedial action to be taken by the Contractor at no additional cost.

C. If any part of a conduit system should be blocked by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary in order to locate and remove the obstruction(s). Any work damaged in the course of removing obstructions shall be repaired or replaced at no additional cost to the Owner.

3.7 PROJECT COMPLETION:

A. Upon completion of the work, remove all waste, rubbish and other materials left as a result of operations and leave the premises in clean condition.

B. Thoroughly clean all exposed portions of the electrical installation, removing all traces of soil, labels, grease, oil and other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned.

C. Vacuum all exteriors of equipment and interiors of equipment having accessible interior compartments to remove all dust, dirt, cable clippings, construction debris, etc.

D. Equipment with damage to painted finish shall be repaired to satisfaction of the Owner.

E. Upon completion of all work and of all tests, the Contractor shall furnish the necessary skilled labor and helpers for operating the system and equipment for a period of one (1) day or eight (8) hours, or as otherwise specified. During this period, instruct the Owner or his representative fully in the operation, adjustment and maintenance of all equipment furnished. Provide at least forty-eight (48) hours notice to the Owner in advance of this period.

F. Thoroughly indoctrinate the Owner’s operation and maintenance personnel in the contents of the record drawings and the operations and maintenance manual required to be submitted under these Specifications.

3.8 INSTRUCTION PERIOD:

A. Prepare written instruction frames for the proper maintenance and operation of any special equipment furnished and installed under this Contract.

B. The contractor shall arrange for on-site instruction of the Owner's representatives by manufacturers of all major items of equipment. The instruction periods shall be consecutive and shall be held after the installations are complete, tested and balanced and the approved documentation is available. The contractor shall be responsible for attendance of the manufacturer's technical representatives and shall coordinate program timing with the Owner.

C. In addition to normal operation, the Owner's representatives shall be instructed on routine maintenance and trouble-shooting.

End of Section 26 00 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including Division 0, Contract Requirements, and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and /or Subcontractor who performs this work. Note also all addenda.

B. Section 26 00 00 General Electrical shall also govern the work under this Section.

C. This Section includes requirements that are binding on other Sections of Division 26.

D. Examine all drawings, data, and coordinate the work of this Section with all related and adjoining work.

1.2 SCOPE OF WORK:

A. Scope of work consists of installation of materials to be furnished under this Section, and without limiting generality thereof consists of furnishing labor, materials, equipment, hoisting, plant, transportation, rigging, staging, appurtenances, and services necessary and/or incidental to properly complete all electrical work as shown on the drawings, as described in these specifications or as reasonably inferred from either as being required in opinion of the Engineer.

B. Work Included: Provide complete electrical services where shown on the drawings, as specified herein and as needed for a complete and proper installation including but not necessarily limited to:

1. General
2. Conduits & Raceways
3. Equipment Labeling
4. Wiring Devices – Receptacles and Switches
5. Wire and Cables
6. Outlet Boxes, Junction Boxes, Pull Boxes, Wireways
7. Supporting Devices
8. Grounding
9. Backboards.

1.3 QUALITY ASSURANCE:

A. Refer to Section 26 00 00.

1.4 SUBMITTALS:

A. Shop Drawings: Submit for all items listed in Paragraph 1.2.B.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Provide only materials that are new and of type and quality specified, or approved equal. Where Underwriters' Laboratories, Inc. have established standards for such materials, provide only materials bearing the UL label.

B. Provide materials and equipment necessary to make installation complete in every detail, and to conform to manufacturers' latest installation instructions, under this contract whether or not specifically shown on drawings or specified herein.

2.2 TEMPORARY FACILITIES:

A. Refer to the requirements of Section 26 00 00 regarding temporary facilities.

B. Scaffolding and other temporary construction shall be rigidly built in accordance with Local and State requirements. Remove from premises upon completion of work.

C. Provide temporary construction required for electrical work as directed by the Engineer.

2.3 RACEWAYS:

A. Rigid Steel Conduit:

1. Shall be manufactured from high strength strip steel, shall be hot dipped galvanized with threads galvanized after cutting, and shall be chromated to form an additional protective layer. Rigid steel conduits shall be UL listed, shall meet the requirements of ANSI C80.1, and shall be as manufactured by Allied Tube and Conduit, Wheatland, or Calconduit.
2. Shall be used in outdoor locations where conduit is exposed to physical damage, sunlight or weather.
3. Shall be used for underground work.
4. Shall be used for horizontal and vertical underground sweeps, horizontal and vertical sweeps below concrete slabs, and for penetrations through concrete slabs.
5. Fittings, couplings and connectors shall be threaded and galvanized or cadmium plated.

B. Rigid PVC Conduit:

1. Shall be heavy wall schedule 40 PVC for underground work and extra heavy wall schedule 80 PVC for underground work below vehicular traffic areas. Joints and fittings shall be solvent welded all to ASTM standards for underground installation and in accordance with Article 352 of the National Electric Code.
2. May be used in lieu of rigid steel conduit except as noted in paragraph 2.3, A, 4 above.
3. Joints shall be made watertight.
4. Shall not be embedded in concrete slabs.
5. Shall not be used above ground.
6. Shall not be used for underground horizontal and vertical sweeps, horizontal and vertical sweeps below concrete slabs, or for penetrations through concrete slabs.
7. Furnish conduit system in Prime Conduit, Cantex, or JM Eagle.

C. Electrical Metallic Tubing:

1. Shall be manufactured from high grade mild strip steel, shall be hot dipped galvanized, and shall be chromated and lacquered to form additional protective layer. EMT conduit shall conform to UL 797 and ANSI C80.3 and shall be as manufactured by Allied Tube and Conduit, Wheatland, or Calconduit.
2. Connectors and couplings for interior work shall be galvanized steel set screw type. Provide gland compression type couplings and connectors for exterior (outdoors) work.
3. Shall be used for all wiring inside the building except where noted differently.

D. Flexible Steel Conduit:

1. Shall be full wall steel flexible conduit, shall be manufactured from high grade strip steel and shall be hot dipped in a molten zinc bath. The steel strip shall be formed into interlocking convolutions that are continuously joined, metal to metal, assuring continuous grounding contact. Flexible steel conduit shall be UL listed and shall be as manufactured by AFC Cable Systems, Greenfield, Anaconda, or Electri-Flex.
2. Flexible steel conduit fittings shall be zinc plated malleable iron squeeze type connectors and zinc plated malleable iron combination couplings
3. May be used in short lengths where EMT cannot be installed due to interferences and obstacles.
4. Provide for final connections to motor driven equipment or where subject to vibration.

E. Liquidtight Flexible Steel Conduit:

1. Shall be similar to flexible steel conduit, but with pressure-extruded moisture and oil-proof outer jacket of gray polyvinyl chloride plastic. Liquidtight flexible steel conduit shall be UL listed (UL 360) and shall be as manufactured by AFC Cable Systems Anaconda, or Electri-Flex.
2. Fittings, couplings and connectors shall be threaded, zinc plated, malleable iron liquidtight type.
3. Provide where located outdoors or in damp or wet areas for final connections to motor driven equipment, or where subject to vibration.

F. Sleeves:

1. Provide EMT sleeves for each conduit and cable passing through interior stud walls and partitions
   a. Set pipe sleeves in place before wallor partition is finished.
   b. Support conduit and cable free from sleeves.
   c. Provide sleeves two pipe sizes larger than the conduit or cable passing through, or provide a minimum of ½" clearance.
2. Provide chrome plated escutcheon plates for each sleeve where exposed to view in finished areas.
3. Sleeves through concrete floors or interior masonry walls shall be Schedule 40 steel pipe, set flush with finished wall, but extending 2 inches above finished floors or shall be in accordance with details on drawings. In all mechanical equipment rooms or penthouses, sleeves shall extend 6 inches above finished floor.
4. Provide GPT Industries WSG galvanized steel wall sleeves for each conduit passing through foundation walls. Galvanized steel wall sleeves shall be schedule 40 steel pipe in sizes through 10" diameter and shall have a 0.375" wall thickness for sizes 12" diameter and larger. WSG galvanized steel wall sleeves shall have a 2" collar (water stop) at the mid-point of the sleeve. The 2" collar shall be continuously welded on both sides to the sleeve. Provide GPT Industries Link-Seal modular waterproof seals at all foundation wall sleeves. Where penetrating existing foundation walls provide a core drilled penetration and Link-Seal modular waterproof seal without the galvanized steel wall sleeve.

2.4 METHODS AND MATERIALS FOR LABELING EQUIPMENT:

A. Transfer Switches:

1. Non-metallic engraved nameplates shall be used to identify device. Nameplates shall be secured to equipment with two screws or rivets. Adhesive nameplates are not acceptable.

2. Letters shall be white on black background.
3. Nameplate letters shall be 1/4" high.
4. Identification nomenclature shall be in accordance with plans. All name nomenclature shall be submitted for approval.

B. Identify the covers of all junction boxes, wireways, and pull boxes installed above ceilings and in unfinished spaces with branch circuit or feeder designations. Identification shall be done with black felt tip permanent marker in a neat and readily legible manner.

C. Provide a non-metallic engraved sign at the service entrance location indicating the location and type of the standby power generator. Letters shall be white on red background and shall be ¼" high.

2.5 CONDUCTORS:

A. Conductors shall be provided in Cerro Wire manufacture or comparable product in Republic Wire or General Cable.

B. All feeder conductors shall be copper, rated 600 volts 90 deg. C., dry and wet locations, type XHHW-2, color coded.

C. All branch circuit conductors shall be copper rated 600 volts, 90 deg. C., dry and wet locations, type XHHW-2, color coded. Branch circuit conductors shall be soft drawn copper with conductivity of not less than 98 percent of ANSI Standard for annealed copper.

D. Grounding electrode conductors and bonding conductors shall be soft drawn copper, ASTM B3 solid bare copper for sizes smaller than #8AWG, ASTM B8 stranded bare copper for sizes #8AWG and larger.

E. Minimum gauge conductors for power and lighting shall be #12 AWG. Increase to #10 AWG for runs exceeding 75'-0", and #8AWG for runs exceeding 150'-0".

F. Wire Size #8 AWG and larger shall be stranded. Wire of size smaller than #8 AWG shall be solid.

2.6 OUTLET, JUNCTION AND PULL BOXES:

A. Provide outlet boxes as required for a complete installation.

B. The minimum box size for all wall outlet boxes shall be nominal 4" square x 2 1/8" deep (2-gang) except where noted differently on the drawings. Provide boxes with single gang or two gang covers as required for the particular application.

C. For exposed work, provide drawn-type boxes with galvanized steel crushed corner exposed work covers. Provide cast boxes for work exposed to wet locations and where called for on the drawings.

D. For above ground pull boxes, provide galvanized code-gauge sheet steel units with screwed on covers, of size and shape required to accommodate wires without crowding, and to suit the location. Provide pull boxes as specified herein, as required for job conditions, and as follows:

1. Indoors: NEMA Type 1.
2. Outdoors or Damp or Wet Locations: NEMA Type 3R.
3. Hosedown and Splashing Water Locations: NEMA Type 4.

E. Provide polymer concrete in-ground pull boxes where indicated on the drawings. Polymer concrete pull boxes shall be Quazite boxes as manufactured by Hubbell or comparable product in Armorcast or Highline manufacture. Pull boxes shall be constructed of Polymer concrete consisting of sand and aggregate bound together with a Polymer resin and reinforced by a heavy weave fiberglass. Pull box covers shall have a skid resistant finish and shall be secured with stainless steel bolts. Provide in-ground pull boxes of size and shape required to accommodate the service and suit the location.

F. Provide H-20 rated in-ground pre-cast concrete pull boxes with cast iron frame and cover where indicated on the drawings. Pre-cast boxes shall be provided with adequate provisions for drainage.

2.7 WIRING DEVICES:

A. All devices shall be furnished in Hubbell or approved equal in Cooper, Pass & Seymour, or Leviton. Devices specified herein are based on Hubbell unless otherwise noted. Receptacle and switch colors shall be as directed by the Engineer.

B. Lighting Switches:

1. Toggle Type: Extra Heavy Duty industrial grade, flush mounting, quiet operation AC type with abuse resistant colored nylon toggle operator, heat resistant composition plastic housing, silver cadmium oxide contacts and copper alloy spring contact arm. Rated at 120-277 VAC, capable of full capacity on tungsten,

2. fluorescent, or LED lamp load. Designed for side or back wiring with up to No. 10 wire, and with #8 brass terminal screws.

	20 AMP	30 AMP
Single Pole	#HBL1221	#HBL3031
Two Pole	#HBL1222	#HBL3032
Three way	#HBL1223	#HBL3033
Four way	#HBL1224	-

C. Receptacles:

1. Ground Fault Duplex convenience receptacles shall be extra heavy duty specification grade, 2 pole, 3 wire grounding, NEMA 5-20R, rated 20AMP at 125 volts AC. Receptacles shall have a solid brass wrap around mounting strap with pre-tensioned ground contacts, tandem modified bypass contacts, all glass circuit board with conformal coating for superior moisture immunity, 7 noise filtering capacitors, heat resistant thermoplastic base and high impact nylon face. Receptacles shall be side wired and shall have a green ground terminal.

Duplex GFCI Receptacle #GFR5362SG

3. Weatherproof enclosures for outdoor GFCI receptacles shall be cast aluminum, single gang vertical Hubbell #WP26M or single gang horizontal Hubbell #WP26MH. Enclosures shall include gasket and mounting screws, shall have ¼" diameter padlock holes, and shall have large cord openings for use with cover closed.

2.10 BACKBOARDS:

A. Backboards shall be constructed of 7 gauge type 316L stainless steel, shall be milled, and shall have a #4 brushed finish.

2.11 GROUND RODS:

A. Ground rods shall be hardened steel with a minimum 10 mil thick electrolytic copper covering (copper-clad) and shall conform to UL 467. Ground rods shall be ¾" dia. x 10' long. Provide ground rods in Blackburn manufacture or comparable product in Erico or Galvan manufacture.

2.12 GROUND WELLS:

A. Provide heavy duty, high traffic area ground wells where indicated on the drawings. Ground wells shall measure 12" diameter X 12" deep, shall be constructed from

concrete, shall come with a cast iron lid (with security bolts) marked “Ground”, and shall have a cast iron ring for support. Ground wells shall be H-20 rated for 36,000 lbs. Provide in ALT #3114-1 or comparable alternate manufacture.

2.13 EXOTHERMIC WELDS:

A. All grounding/bonding connections to ground rods shall be made with exothermic welds. Provide in Cadweld or comparable product in Thermoweld or JMV manufacture.

2.14 ACCESS PANELS:

A. Provide access panels for electrical equipment and wiring splices which are not readily accessible. This includes electrical equipment and wiring splices installed above hung ceilings which are not readily removable, within walls, inside chases, or inside dead cavity spaces.

B. Access panels shall be prime painted steel, with screwdriver lock, shall bear the same fire rating as the wall or ceiling in which they are installed, and shall be of sufficient size for wiring splice access or electrical equipment removal and replacement. Access panels shall be provided in Milcor manufacture, or approved equal. Provide Milcor Type A in acoustical tile surfaces, Type K for plastered surfaces, and Type M for masonry construction.

C. Ceiling access panels 18” x 18” or larger shall be hinged.

2.15 OTHER MATERIALS:

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the contractor subject to the approval of the engineer.

B. Provide miscellaneous hardware and support accessories, including unistrut, channels, Jack chain, support rods, nuts, bolts, screws, and other such items, with galvanized or Cadmium plated finish, or other approved rust inhibiting coatings.

PART 3 - EXECUTION

3.1 GENERAL:

A. Unless specifically noted or shown otherwise, install all equipment and material specified herein or shown on drawings whether or not specifically itemized herein.

PART 3 covers particular installation methods and requirements peculiar to certain items and classes of materials and equipment.

B. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until satisfactory conditions are corrected.

C. The electrical drawings are diagrammatic, but are required to be followed as closely as actual construction and work of other trades will permit. Where deviations are required to conform with actual construction and the work of the other trades, make such deviations without additional cost to the Owner.

D. Data indicated on the drawings and in these specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels and other conditions will be governed by actual construction and the drawings and specifications should be used only for guidance in such regard.

E. Verify all measurements at the building. No extra compensation will be allowed because of differences between work shown on the drawings and actual measurements at the site of construction.

F. Do not scale drawings. Scale indicated on drawings is for establishing reference points only. Actual field conditions shall govern all dimensions.

G. Coordinate:

1. Coordinate as necessary with other trades to assure proper and adequate provisions in the work of those trades for interface with the work of this Section.
2. Coordinate delivery of electrical equipment to project prior to installation. Equipment stored for an extended period of time prior to installation may be subject to rejection by Architect.
3. Coordinate the installation of electrical items with the schedule for work of other trades to prevent unnecessary delays in the total work.
4. Where electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear the encroachment.
5. Arrange installation to provide access to equipment for easy maintenance and repair.

3.2 INSTALLATION OF RACEWAYS AND FITTINGS:

A. Install wire and cable in approved raceways as specified and as approved by authorities having jurisdiction.

B. All conduits shall be installed exposed to view in mechanical and electrical rooms and where run overhead in rooms without ceilings.

C. Run conduit parallel to or at right angles with lines of the building, to present a neat appearance.

1. Make bends with standard conduit elbows or conduit bent to not less than the same radius.
2. Make bends free from dents and flattening.

D. Provide code sized conduit unless a larger size is shown on the drawings or specified herein. Minimum conduit size shall be ¾" diameter.

E. Securely and rigidly support conduit throughout the work with approved conduit clips and hangers all in conformance with code seismic requirements.

1. Do not use mechanics wire for supporting conduit.
2. Do not support conduits on hung ceilings or from mechanical or electrical equipment.
3. Steel supports and racks shall be galvanized steel channel and fittings, unistrut or approved equal.
4. Provide clamps and support rods as required.
5. Steel support rods or support bolts for conduits shall be 1/8 inch diameter for each inch or fraction thereof of diameter of conduit size, but no rod or bolt shall be less than ¼" in diameter.
6. Horizontal and vertical conduit supports shall not be more than 10' apart or more than 1' from any fitting.
7. Install conduit so it is not in contact with, or resting on, plumbing, fire protection, or HVAC equipment, piping, or ductwork.

F. Maintain at least 3" clearance between conduits and heating pipes when running parallel to these pipes, and at least 1" clearance when running perpendicular to these pipes.

G. Provide double locknuts on all conduits terminating in sheet metal enclosures.

H. Provide expansion couplings for conduits where such conduits are subject to thermal expansion and contraction. Provide combination deflection/expansion couplings for conduits where such conduits cross through building expansion joints.

I. Provide full wall steel flexible conduit for all conduit penetrations through fire walls. Full wall steel flexible conduit shall be 3-hour through penetration fire wall rated and shall be as manufactured by AFC Cable Systems, or approved equal.

J. Install waterproof seals around all conduit penetrations through basement walls, floors, or foundation walls.

K. Where conduit is installed underground or is exposed to weather or wet areas make all joints watertight.

L. Provide necessary sleeves and chases where conduits and cables pass through floors, walls, ceilings, and roofs, and provide other necessary openings and spaces, all arranged for in proper time to prevent unnecessary cutting. Perform cutting and patching in accordance with the provisions for the original work.

M. Provide offsets prior to entrance into outlet boxes and other electrical equipment for proper adjustment to finished building surfaces. Exercise care when roughing-in conduits which turn up or down to surface mounted panelboards or cabinets, so that conduit extensions to cabinet will be fitted close to wall. Where possible, provide back entry into surface mounted boxes or equipment items.

N. Carefully clean and dry all conduit before installation of conductors. Do not pull wires into conduit system until the entire run is complete. Provide Prime conduit plugs and end caps to exclude dust and moisture during construction.

O. Lubricants or cleaning agents which might have deleterious effect on conductor coverings shall not be used for drawing conductors into raceways.

P. Provide minimum 3/16 inch diameter twisted nylon fish cord in all empty raceways. Provide tag on each end indicating location of other end. Fish cord shall have minimum of 200 pounds tensile strength.

Q. All wiring shall be installed in electrical metallic tubing unless otherwise specified herein or called for on the drawings.

1. Use flexible conduit for final connections to motor driven equipment, chain hung light fixtures, or where subject to vibration. Where such equipment is located in wet areas or exposed to weather use liquid-tight flexible conduit. Flexible connections shall be minimum of 18 inches and maximum of 6 feet long with

grounding conductor. Flexible connections shall be used prior to attachment of conduit to equipment housing.

3.3 SLEEVES:

1. Provide EMT sleeves for each conduit and cable passing through interior stud walls and partitions
   a. Set pipe sleeves in place before wallor partition is finished.
   b. Support conduit and cable free from sleeves.
   c. Provide sleeves two pipe sizes larger than the conduit or cable passing through, or provide a minimum of ½" clearance.
2. Provide chrome plated escutcheon plates for each sleeve where exposed to view in finished areas.
3. Sleeves through concrete floors or interior masonry walls shall be Schedule 40 steel pipe, set flush with finished wall, but extending 2 inches above finished floors or shall be in accordance with details on drawings. In all mechanical equipment rooms or penthouses, sleeves shall extend 6 inches above finished floor.
4. Provide GPT Industries WSG galvanized steel wall sleeves for each conduit passing through foundation walls. Galvanized steel wall sleeves shall be schedule 40 steel pipe in sizes through 10" diameter and shall have a 0.375" wall thickness for sizes 12" diameter and larger. WSG galvanized steel wall sleeves shall have a 2" collar (water stop) at the mid-point of the sleeve. The 2" collar shall be continuously welded on both sides to the sleeve. Provide GPT Industries Link-Seal modular waterproof seals at all foundation wall sleeves. Where penetrating existing foundation walls provide a core drilled penetration and Link-Seal modular waterproof seal without the galvanized steel wall sleeve.

3.4 CONDUCTOR INSTALLATION:

A. General:

1. The interior of all conduits shall be cleared of burrs, moisture, dirt and obstructions before wires are pulled.
2. Lubricant for pulling wires shall be inert to cable and conduit, shall not in any way restrict ease of pulling through conduit with passage of time, and shall be special lubricant designed specifically for cable pulling and shall be chemically compatible with cable.

B. Color Coding:

1. Consistent phase identification of all conductors shall be maintained as follows:

	120/208V
Phase A	Black
Phase B	Red
Phase C	Blue
Neutral Wire	White

Provide colored plastic tape of specified color code identification for large size conductors available only in black. Wrap tape three complete turns around conductor, at ends and at connections and splices. Provide same color coding for switch legs as corresponding phase conductor.

C. Minimum Conductor Sizes:

1. The minimum branch circuit conductor size shall be #12AWG. Provide #10AWG conductors for branch circuits where the conductor run exceeds 75 feet, and #8AWG conductors where the conductor run exceeds 150 feet.

D. Provide the number of conductors required for a given branch circuit, or as required for circuitry, whether indicated on the drawings or not.

E. Neutral Conductors:

1. All branch circuits shall be installed with a separate neutral conductor. Shared neutrals for groups of branch circuits shall not be permitted.

F. Provide each circuit with a dedicated ground wire back to its respective panel ground bar. Size all ground wires in accordance with NEC requirements. Use #12AWG minimum size.

G. Identify conductors passing through pull boxes, junction boxes, and wireways to indicate circuit designation. Identify pull boxes and junction boxes as specified herein.

H. Phase conductors shall be connected to phase supply mains in proper rotation to assure balanced condition on panel. Circuit numbers assigned on drawings are for convenience only. Provide typed circuit directories for all panelboards at conclusion of work, representing circuits as actually connected to panelboard. Directories shall note the equipment, devices and rooms served by each branch circuit.

I. Branch circuit wiring and arrangement of home runs have been designed for maximum economy consistent with adequate sizing for voltage drops, circuit ampacities and other considerations.

1. Install the wiring with circuits arranged as shown on the drawings, except as otherwise approved in advance by the Engineer.
2. Do not make changes and rearrange circuits without prior approval.
3. If more than 3 current carrying conductors are installed in one conduit they shall be derated in accordance with the National Electric Code. Do not install more than three 30 Amp single phase or four 20 Amp single phase circuits in the same conduit. Do not run emergency and normal power wiring in the same conduit.

J. Splices and Connections:

1. Make splices electrically and mechanically secure with pressure-type connectors.

   a. For wires size #8AWG and smaller, provide solderless, screw-on connectors, “Scotch-Lock” or equal, 600V rating, of size and type to manufacturer’s recommendation, with temperature ratings equal to the conductor insulation.

   b. Make splices and terminations to conductors #6AWG and larger with corrosion-resistant, high conductivity, pressure indent, hex screw or bolt clamp connectors, with or without tongues, designed specifically for intended service. Connectors for cables 250 kcmil and larger shall have two clamping elements or compression indents. Terminals for bus connections shall have two bolt holes. Splitbolt connectors, Burndy or equal, shall be acceptable for all splices of conductors #6AWG and larger.

2. Insulate splices with a minimum of two layers of all weather, heavy duty, abrasion resistant, 8.5 mil thick, 105 degree C. rated vinyl electrical tape where insulation is required. Tape splices 1 ½ times the thickness of the conductor insulation.

3. Provide high conductivity copper alloy bolt-on lugs with pressure plate and socket set screw or hex head screw to attach wire and cable to disconnect switches, transformers, and other electrical equipment as required.

4. Provide Greaves PT-R series cable reducing adaptor plugs where required for terminating oversize cable to standard size equipment lugs. Conductor strands shall not be cut in order to fit equipment lugs.

5. Provide antioxidant joint compound for all conductor connections.

3.5 OUTLET BOXES:

A. Install outlet boxes at uniform heights and straight and true with reference to walls, floors, ceilings and casework.

B. Provide knockout plugs in boxes with unused openings.

C. Secure all outlet boxes to building structure with metal straps, rods, or bolts independently of entering conduits or cables.

3.6 PULL BOXES AND JUNCTION BOXES:

A. Provide pull boxes and junction boxes where shown on the plans and where required to facilitate proper pulling of wires and cables. Install pull boxes or pull fittings no less than one every 100 ft. of straight horizontal conduit run, or three 90 degree bends, unless otherwise noted.

B. For site work provide pull boxes no less than one every 400 feet of straight run or two 90 degree bends, unless shown or noted differently.

3.7 WIRING DEVICES:

A. Install receptacles vertically with grounding posts at top of device, except locate grounding post to left for horizontal mounting.

3.8 GROUNDING SYSTEM:

A. Provide a complete grounding system which will thoroughly ground the non-current carrying metal parts of every piece of installed equipment, as described herein and as indicated on the drawings.

B. System shall be mechanically and electrically connected to provide an independent return path to the grounding sources.

C. Each grounding conductor shall have a minimum capacity of 25 percent of the rated capacity of the equipment it grounds, unless otherwise indicated.

D. The minimum size of grounding conductors shall be No. 12 AWG copper. Insulation color of grounding conductors shall be green.

E. Provide a separate green ground conductor for each feeder and branch circuit.

F. Provide ground rods as specified herein and as called for on the drawings.

G. Provide exothermic weld ground connections as specified herein and as called for on the drawings.

H. Tests: Entire system shall be thoroughly tested on completion for ground continuity and capacity. Provide not more than 10 ohms resistance between main ground system and equipment frame system neutral and/or derived neutral point.

3.9 SPECIAL REQUIREMENTS:

A. Wiring shall be bundle tied where passing through pull boxes, wireways, and panelboards in neat and orderly manner with plastic cable ties. Cable ties shall be Ty-Raps as manufactured by Thomas & Betts, or equal.

B. Turn branch circuit and auxiliary system wiring out of wiring gutters at 90 degrees to circuit breakers and terminal lugs.

C. The location of outlets may vary due to structural considerations or due to minor changes in millwork or architectural layout. Adjustments to height or reasonable adjustments to locations of outlets, etc. as shown on the drawings shall be done at no additional charge.

D. Provide miscellaneous hardware and support accessories, including channels, unistrut, jack chain, support rods, nuts, bolts, screws, and other such items, with galvanized or cadmium plated finish, or other approved rust inhibiting coatings.

E. Unload electrical equipment and materials delivered to site. Pay cost for rigging, hoisting, lowering and moving electrical equipment on site, in building or on roof. During construction, provide additional protection against moisture, dust accumulation and physical damage of electrical equipment. Provide temporary heaters within units, as approved to evaporate excessive moisture and provide ventilation as required.

3.10 TESTING AND INSPECTION:

A. Provide personnel and equipment, make required tests, and secure required approvals from the Architect and governmental agencies having jurisdiction.

B. When material and/or workmanship is found to not comply with the specified requirements, within three days after receipt of notice of such non-compliance remove the non-complying items from the job site and replace them with items complying with

the specified requirements, all at no additional cost to the Owner.

C. Perform all required adjustments and settings. Verify and correct deficiencies as necessary including voltages, tap settings, trip settings and phasing of equipment from distribution system to point of use.

D. Provide all necessary testing equipment.

E. Test wiring, buswork, and connections for continuity and ground by "megger" test. Minimum insulation resistance between conductors and ground shall be as follows:

1. For circuits of #14 or #12 AWG wire: 1,000,000 ohms.
2. Conductor current carrying capacities from 25 to 50 amperes, inclusive: 250,000 ohms.
3. Conductor current carrying capacities from 51 to 100 amperes, inclusive: 100,000 ohms.
4. Conductor current carrying capacities from 101 to 200 amperes, inclusive: 50,000 ohms.
5. Conductor current carrying capacities from 201 to 400 amperes, inclusive: 25,000 ohms.
6. Conductor current carrying capacities from 401 to 800 amperes, inclusive: 12,000 ohms.
7. Conductor current carrying capacities over 800 amperes: 5,000 ohms.

Submit "megger" test results to the Engineer for review.

F. Main ground electrode system shall not exceed 10 ohms unless specified otherwise.

1. Verify ground resistance by ground continuity test between main ground system and equipment frame system neutral and/or derived neutral point.

2. Perform ground continuity test by passing minimum of ten Amps DC between ground reference system and ground point. Calculate resistance by voltage drop method.

G. In the Owner's Presence:

1. Test all parts of the electrical system and prove that all such items provided under this Section function electrically in the required manner.

3.11 PROJECT COMPLETION:

A. Upon completion of the work of this Section, thoroughly clean all exposed portions of the electrical installation, removing all traces of soil, labels, grease, oil and other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned.

B. Vacuum all exteriors and interiors of panelboards and transfer switches to remove all dust, dirt, cable clippings, etc.

C. Equipment with damage to painted finish shall be repaired to satisfaction of the Owner.

D. On the first day the facility is in operation, for at least eight hours, at a time directed by the Owner, provide a qualified foreman and crew to perform such electrical work as may be required by the Owner.

E. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the operations and maintenance manual required to be submitted under these Specifications.

End of section 26 05 00

PART 1 - GENERAL

1.1 SCOPE:

A. General: Provide the standby power system in accordance with the contract documents, including Sections 26 00 00 and 26 05 00.

B. Scope of work includes but is not limited to:

1. Engine generator unit
2. Critical silencer, battery charger and other accessories to make system complete and ready to operate.
3. Wiring of block heater and battery charger.
4. Sound attenuating weather protective enclosure.

1.2 QUALITY ASSURANCE:

A. Codes and Standards: Refer to Section 26 00 00.

B. Comply with ASME B15.1.

C. Comply with NFPA 37.

D. Comply with NFPA 70.

E. Comply with NFPA 110.

F. Comply with UL 2200.

G. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

1.3 SUBMITTALS:

A. Shop Drawings, Product Data, and Certifications that products conform to requirements: Submit for all items provided as part of the Work of this Section, including but not limited to those items listed in Paragraph 1.1.B.

1.4 WARRANTY:

A. Provide a 5 year comprehensive limited warranty for the generator set and all associated equipment. The warranty shall be comprehensive and shall cover the generator set, sound attenuating weather protective enclosure, critical silencer, controls, battery charger, block heater, and automatic transfer switches. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc. The warranty shall be effective from Date of Substantial Completion. The contractor shall submit the manufacturer's warranty for approval.

PART 2 - PRODUCTS

2.1 ENGINE - GENERATOR SET:

A. Standby power generator shall be provided in Kohler Model 200REZXB spark-ignited engine-generator set and as represented in the published specifications for that model. Set shall be rated for 200 KW, 250 KVA, at 0.8 PF, 60 Hz. 3 phase 4 wire, 120/208 volts on a continuous standby basis. The alternator shall be Kohler #4UA13 with a standby rating of 694 amps at 208V, 3-phase. Engine generator set shall be mounted on a heavy duty steel base to maintain proper alignment between components, and shall incorporate vibration isolators of the type and quantity as specified by the set manufacturer.

B. Engine: Engine shall be stationary, inline 6 cylinder, 4 cycle, 674 cubic inches displacement, 1800 RPM, EPA Tier 3, natural gas fueled. Engine shall be capable of driving the generator of this rating on a continuous standby basis for the duration of normal source interruptions per SAE J1349 conditions.

C. Engine components shall include the following:

1. A 24 volt DC, solenoid shift, electric starter as required by manufacturer.
2. Positive displacement mechanical full pressure lubrication oil pump, full flow lubrication spin-on oil filter, pressure relief valve, dipstick oil level indicator, and oil drain valve with hose extension.
3. Heavy duty dry element air cleaner.
4. Electronic governing system to control generator system frequency.
5. Engine mounted thermostatically controlled water jacket heater to aid in quick starting. Heater shall be rated single-phase, 208 volts, 2500W, and shall be disconnected whenever the engine starts.
6. Engine protection devices shall have sensing elements located on the engine to initiate the following preliminary alarms and engine shutdowns:

Low coolant temperature alarm
Low Lubrication oil pressure alarm
High coolant temperature alarm
Low lubrication oil pressure shutdown
High coolant temperature shutdown
Over speed shutdown
Over crank lockout
High, low, and weak battery voltage alarm
Fail to crank shutdown

7. Minimum 45 Amp engine starter battery charging alternator, with solid-state voltage regulator.

D. Engine Cooling System:

1. The engine shall be cooled by a unit-mounted closed loop radiator system including belt-driven pusher fan, coolant pump and thermostat temperature control. The cooling system shall be rated for full rated load operation in 122 degrees F (50 degrees C) room ambient condition with the ambient temperature as measured at the generator air inlet. The cooling capability of the generator set shall be demonstrated by prototype tests on a representative generator set model. These tests will be conducted by the generator set manufacturer; calculated data from the radiator manufacturer only is not sufficient.
2. The cooling system shall be filled with 50/50 ethylene glycol/water mixture by the equipment supplier.
3. Rotating parts shall be guarded against accidental contact.

E. Engine Exhaust System:

1. Exhaust silencer shall be provided for engine of size recommended by manufacturer. Silencer shall be of the critical type. Furnish with 1/2" drain.
2. Flexible stainless exhaust connection shall be provided as required for connection between engine manifold and exhaust line, in compliance with applicable codes and regulations.
3. Provide rain cap at exhaust pipe termination.
4. Exhaust silencer shall be located inside the enclosure. Roof mounted silencer will not be accepted.

F. Fuel System:

1. The fuel system shall be natural gas, 2115 cubic feet/hr. fuel consumption at full load.
2. Required gas pressure to the engine is 7” to 11” w.g.
3. Engine fuel piping shall be factory installed and tested.

G. Generator:

1. Generator shall be single-bearing, self-aligning, four-pole, synchronous type, revolving field 2/3 pitch, with amortisseur windings, with direct drive centrifugal blower for proper cooling and minimum noise, with temperature compensated solid-state voltage regulator, with brushless PMG exciter system. The use of brushes and/or slip rings will not be accepted.
2. Generator shall be directly connected to engine flywheel housing and driven through a flexible coupling to insure permanent alignment; gear driven generators are not acceptable under this specification.
3. Insulation shall meet NEMA standards for Class H. The maximum temperature rise shall not exceed 130 deg. C. at 40 deg. C. ambient under standby ratings. Generator design shall prevent potentially damaging shaft currents.
4. The broad range reconnectable generator shall have 12 leads brought out to allow connection by user to obtain any of the available voltages for the unit.
5. Voltage regulator shall be solid-state design and shall function by controlling the exciter magnetic field between stator and rotor to provide no load to full load regulation of rated voltage within 0.25% during steady-state conditions. The engine set and regulator must sustain at least 90% of no load voltage for ten (10) seconds with 300% of rated load at near zero power factor connected to its terminals. The voltage regulator shall be of an asynchronous pulse width modulated design that it insensitive to severe load induced waveshape distortion from SCR or thyrister circuits such as those used in battery charging (UPS) and motor speed control equipment.
6. The generator, exciter and voltage regulator shall be designed and manufactured by the engine-generator set manufacturer so that the characteristics shall be matched to the torque curve of the prime mover. This design allows the prime mover to use its fullest power producing capacity (without exceeding it or over compensating) at speeds lower than rated, to provide the fastest possible system recovery from transient speed

dips. A system that routinely selects a linear-type (straight line) constant volts/hertz characteristic, without regard for the engine power and torque characteristics will not meet this specification. These characteristics shall be demonstrable as follows:

a. With engine-generator set operating at rated speed voltage and load, reduce engine speed to half rated by manually overriding the engine speed governor control. Engine-generator set must recover to full speed with the rated load connected when the engine speed governor control is returned to its normal mode.
b. Calculation must demonstrate that the exciter and voltage regulator will permit utilization of at least 80% of maximum available prime mover torque at all engine speeds between 50% and rated speed, and with rated unity power factor load connected to its terminals.

7. Generator design shall be of the self-protecting type, as demonstrated by the prototype short-circuit test as described under "Testing" herein. All other generator performance criteria shall be equal to that of the specified equipment.
8. Provide auxiliary contact, normally closed when engine/generator unit is not running and open when engine/generator unit is running.

H. Engine-Generator Set Control:

1. Provide a “Decision-Maker 550” unit mounted control module that is factory built, wired, tested, and shock-mounted by the generator manufacturer. Controls and features shall include the following:
    - NFPA 99 and 110 compliant
    - Digital Microprocessor
    - 128 X 128 pixels graphic led backlight LCD
    - 3 phase sensing digital voltage regulation
    - Suitable for operation in ambient temperatures from -40 degrees C to +70 degrees C
    - RS232 and RS485 Canbus remote ports
    - Waterproof connections
    - Programmable I/O
    - Built-in PLC
    - Engine function monitoring and control
    - Full range standby operation
    - Programmable auto-crank
    - Emergency stop

- Auto-off-manual switch
- Full system status on all AC output and engine function parameters
- Service reminders, trending, fault history
- Selectable low-speed exercise
- 2-wire start controls
- Electronic governor frequency regulation
- Isochronous steady state regulation

Engine Protection

- Overspeed shutdown.
- Low oil pressure shutdown.
- High coolant temperature shutdown.
- Low coolant shutdown.
- Crank limiter.
- Fail to crank shutdown.

Operator Interface

- Off/manual/auto mode switch.
- Manual run/stop switch.
- Panel lamp/test switch.
- Emergency stop switch.
- Not in auto position
- ATS selection
- Exercise speed

AC Alternator Data

- Voltage (all phases)
- Power factor
- KVAR
- 3 phase AC current.
- Frequency.
- KW
- Overvoltage

Engine Data

- DC voltage.
- Lube oil pressure.
- Coolant temperature.
- Engine speed

Other Data

- Genset model data.
- Run hours.
- Fault history
- Service reminders

Governing

- Integrated digital electronic voltage regulator.
- Three phase L-N sensing.
- Configurable torque matching.
- PMG

I. Main Line Circuit Breakers:

1. Provide 600A/3P and 200A/3P rated main line solid state trip molded case circuit breakers. The circuit breakers shall be installed in the generator junction box.

J. Auxiliary Equipment:

1. Starting Battery: Batteries shall be supplied for engine and shall be mounted in a battery rack within the engine-generator set skid-base. Furnish all cables and connectors. Batteries shall be either 12 or 24 Volt DC as recommended by the generator set manufacturer. Batteries shall have sufficient capacity to provide 1000 Amps of cranking current at 0 degrees F for a minimum of 10 minutes.
2. 10 Amp Battery Charger: Factory mounted and wired in generator enclosure
3. Vibration Isolators: Engine-generator set shall be mounted on vibration isolators either internal or external to the set skidbase.
4. Remote Alarm Annunciator: Comply with NFPA 110. An LED labeled annunciator with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.
5. Battery heater.

K. Weather Protective Sound Attenuating Enclosure:

1. Provide the manufacturers weather protective sound attenuating housing for the generator set. The housing shall be of aluminum construction, shall have stainless steel hardware, shall have weather protective seals around all doors, and shall have fade, scratch, and corrosion resistant automotive grade textured finish.

2.2 AUTOMATIC TRANSFER SWITCHES:

A. The transfer switches shall be furnished and warranted by the manufacturer of the engine generator set to ensure one source of responsibility and compatibility for the complete EMERGENCY/STANDBY POWER SYSTEM. The manufacturer shall provide factory trained parts and service support through a factory authorized distributor or service center that is regularly doing business in the area of the installation.

B. The transfer switches shall be U.L. listed per standard 1008. The transfer switches shall be suitable for use on emergency standby systems in accordance with ANSI-CI, NFPA 70, NFPA 110, and rated for total system load as described in section 1 of U.L. 1008.

C. The transfer switches shall be service entrance rated and shall be rated for 120/208V, 3 phase, 60 hertz, 200 amps for the 124 building and 600 amps for the P-123 building. The transfer switches shall be 4 pole type with switched neutral. The transfer switches enclosures shall be NEMA 4X cabinet with a key locking front door. The transfer switches shall incorporate an isolating mechanism and overcurrent protection on the utility supply. The transfer switches shall be manufactured by Kohler, model #KEP-DCVF-0200SMM and #KEP-DCVF-0600SNN. Provide software Adjustable Time Delays in the switches for the following:

Delay	Adjustment
Start	0 to 10 sec.
Transfer	0 to 300 sec.
Retransfer	1 to 30 min.
Stop	1 to 30 min.
Time delay neutral	.1 to 10 sec.

D. The transfer switches shall be provided with engine starting contacts, a programmable exerciser clock, and digital meter.

E. The transfer switches shall include voltage and frequency monitoring of the normal power and emergency power sources.

PART 3 - INSTALLATION

3.1 SHIPPING AND DELIVERY:

A. The gen-set shall arrive at the job site fully assembled, piped and wired. The only assembly required at the site will be to install miscellaneous accessories, and to make closing cable connections.

3.2 INSTALLATION OF GENERATOR ACCESSORIES:

A. Provide branch circuit wiring for accessory equipment including battery charger, battery heater, and block heater.

3.3 TESTING:

A. The electric generating system consisting of prime mover, generator, governor, coupling and all controls must have been tested as complete unit on representative engineering prototype. Before shipment of the equipment the engine-generator set shall be tested for performance and proper functioning of control and interfacing circuits.

B. Field Test After Installation:

1. The complete installation shall be initially started and checked out for operational compliance by factory-trained representative of the engine-generator set manufacturer. The engine lubrication oil and antifreeze, as recommended by the manufacturer for operation under environmental conditions specified, shall be provided by the engine-generator set supplier.
2. Upon completion of initial start-up and system checkout, the supplier of the system shall perform an eight (8) hour resistive load bank test, with the engineer notified in advance, to demonstrate load carrying capability and voltage and frequency stability.

Test loading shall be conducted in the following order:

- 25% of nameplate rating for 30 minutes.
- 50% of nameplate rating for 2 hours.
- 75% of nameplate rating for 2 hours.
- 100% of nameplate rating for 2 hours.
- 50% of nameplate rating for 1.5 hours.

Record voltage, frequency, load current, oil pressure, and coolant temperature at 15 minute intervals. Make necessary adjustments.

3. After the load bank test the Contractor shall perform a simulated power outage test to demonstrate generator start-up and transfer switch operation. This test shall be initiated by opening the transfer switches utility supply isolating mechanism. The simulated power outage test shall be done in the presence of the Authority Having Jurisdiction and the Authority Having Jurisdiction shall have final approval of the installation.

3.4 TRAINING:

A. Provide a four hour training session for the Owner's personnel. Training session shall cover operation and maintenance of the engine-generator set, transfer switches, and all related accessories.

3.5 PARTS AND SERVICE:

A. The bidder will be the authorized dealer of the engine generator set and will have personnel who are factory-trained and authorized to provide service and parts at any time during the day or night. A description of the service and parts support capability will be included with the submittals.

B. The authorized dealer shall be able to provide 24 hour emergency service and that service shall be rendered within four hours of the placement of the service call.

3.6 MAINTENANCE:

A. The bidder shall furnish three copies of operating and maintenance instructions and illustrated parts books, covering the engine-generator transfer and auxiliary equipment that will require operating instructions and periodic maintenance.

END OF SECTION 26 30 00

SECTION 31 00 00 – EARTHWORK

PART 1 – GENERAL

1.1 RELATED DOCUMENT:

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY:

A. Provide all labor, materials, necessary equipment and services to complete the work called for in this Section or as shown on the plans, including but not necessarily limited to the following:

1. Rough and finish grading.
2. Excavating, backfilling and compacting for utilities, pavements and retaining walls.
3. Addition of processed aggregate base or borrow (if required), and disposal of unsuitable or excess materials.
4. Base course material for slabs on grade, curbing, sidewalks, and pavements.
5. Excavation of rock for structures, pavement and utilities.
6. Sand
7. Rip Rap, Gravel Fill, and free draining pervious fill.
8. Erosion control blanket
9. Geotextile (filter fabric).

B. Related Work: The following sections contain requirements that may apply to this section:

1. Division 2, Section "Bituminous Concrete".
2. Division 2, Section "Site Preparation and Demolition".

1.3 SUBMITTALS:

A. Submit for review sieve analysis of off-site borrow and all different fills for review if required. Provide test reports of existing material to determine if suitable for reuse.

B. Product data for the following:

1. Each type of plastic warning tape.
2. Filter Fabric.
3. Erosion Control Blanket.

C. Submit one modified proctor density test for each fill type in accordance with ASTM Method T-180.

1.4 QUALITY ASSURANCE:

A. All work of this section shall be provided in accordance with the latest edition of State of Connecticut Department of Transportation Form 817 which is considered to be part of this specification, the same as if fully set forth herein.

1.5 DEFINITIONS:

A. Excavation consists of removal of material encountered to subgrade elevations indicated and the reuse or subsequent disposal of excess materials removed. All excavation shall include but not limited to the removal of earth, rock, and unsuitable material as required to construct the buildings and pavement to the lines and grades shown in the drawings.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Owner's Representative. Unauthorized excavation, as well as remedial work directed by Owner's Representative, shall be at Contractor's expense.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify Owner's Representative, who will make an inspection of conditions. If the Owner's Representative determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Owner's Representative.

D. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

E. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

F. Subbase Course: The layer placed between the subgrade and the base course in a paving system or the layer placed between the subgrade and surface course of a walk.

Subbase Material: Subbase material shall consist of processed aggregate in conformance with CTDOT Form 817, M.05.01. The minimum depth of subbase shall be as shown on the drawings and the contractor shall add additional processed aggregate base material as required.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground.

H. Unsuitable Materials: ASTM D 2487 Soil Classification Groups:

SC: Clayey sands, sand-clay mixtures.
ML: Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity.
CL: Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
OL: Organic silts and organic silty clays of low plasticity.
MH: Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
CH: Inorganic clays of high plasticity, fat clays.
OH: Organic clays of medium to high plasticity, organic silts.
Pt: Peat and other highly organic soils.

1.6 PROTECTION:

A. Underpin adjacent structures that may be damaged by excavation work, including service utilities and pipe chases.

B. Notify Owner's Representative of unexpected subsurface conditions and discontinue effected work in area until condition is resolved.

C. Protect bottom of excavations and soil adjacent to and beneath foundations against freezing when atmospheric temperature is less than 35°F.

D. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, and soil changes detrimental to stability of subgrades. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

E. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations. Do not use trench excavations as temporary drainage ditches.

F. Grade top perimeter of excavation to prevent surface water runoff into excavation.

1.7 SPECIAL REQUIREMENTS:

A. Before beginning work, the Contractor shall check, in the field, existing grades and layout as shown on the drawings and report any discrepancies that will affect the work of this contract to the Owner's Representative. Commencement of work will be implied to mean acceptance. No adjustments will be made for discrepancies discovered after work has begun.

B. The Contractor shall carefully protect from disturbance or damage all land monuments.

1.8 PROJECT CONDITIONS:

A. Site Information: Data in subsurface investigation reports was used for the basis of the design and are available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from subsurface data by Contractor.

B. Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

C. Contractor shall be responsible to contact Call Before You Dig (CBYD), telephone 1-800-922-4455, for information as to location of existing utilities and to obtain a permit number 48 hours before start of excavation. In the event tht CBYD is unable to provide the locations it shall be the Contractor’s responsabiblity to hire a private utility locating contractor to supply this information.

1. 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 utility owner.
2. Do not interrupt existing utilities serving facilities occupied by owner or others, during occupied hours, except when permitted in writing by Owner's

Representative and then only after acceptable temporary utility services have been provided.

3. Provide the Owner's Representative a 48-hour minimum notice and wait to receive written approval to proceed before interrupting and utility.

D. Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by State authorities.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created bye earthwork operations.

PART 2 - PRODUCTS

2.1 MATERIALS:

Existing site materials can be used for the following applications if in conformance with the applicable Section of the 817. Contractor to mix, pulverize and add additional material as required to utilize material at no additional cost to the Owner.

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations. Borrow shall comply with Article 2.07.02 of the 817.

B. Granular Fill shall comply with Article M.02.01 of the 817. Use a maximum 3 in. size for fill placed within 12 in. of concrete slabs or foundations.

C. Compacted Processed Subbase shall conform to 817, Section 2.12 or consist of processed aggregate in conformance with M.05.01, CTDOT Form 817.

D. Bank or crushed stone shall conform to 817, Section M.02 and consist of sound, durable stone free of soft disintegrated pieces, mud, dirt, organic, or other injurious material.

E. Bedding Material and Sand: Materials shall comply with Articles M.08.01-21 of the 817.

F. Free-Draining Material shall conform to 817, Section M.02.07.

G. Erosion Control Matting shall conform to Section M.13.09 of 817.

H. Geotextile (Filter Fabric) shall conform to Section 7.55 of the 817 and shall meet the following minimum requirements:

minimum fabric weight of 16 oz./sy
minimum grab tensile strength of 350 lbs
minimum puncture resistance of 195 lbs

2.2 ACCESSORIES:

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.

PART 3 - EXECUTION

3.1 GENERAL:

A. Stockpile excavated materials acceptable for backfill and fill where directed on the drawings, or as directed by tgh. Place, grade, and shape stockpiles for proper drainage. Place erosion controls as required.

B. Locate and retain soil materials away from edge of excavations, and grading. Do not store within drip line of trees indicated to remain.

C. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill off-site in a legal manner at no expense to the Owner.

D. Excess material may be generated as a result of excavations, and grading. All excess material shall be disposed of legally off-site at the Contractor's expense.

E. Site areas requiring new fill shall be stripped of all topsoil, organics, and soft yielding material prior to the depositing of fill material.

F. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding the project site and surrounding area. The Contractor shall not convey water to any area outside the project limits.

3.2 EXCAVATION:

A. Before starting excavation, establish location and extent of any underground utilities occurring in work area.

B. Excavations shall be carried to a suitable undisturbed subbase. This subbase shall be free of any soft or yielding material.

C. All excavations shall be made to the proper elevations and dimensions indicated on the drawings with proper allowance made for structural fill and erection of forms. All excavation where shoring is required must comply with OSHA shoring provisions and campus safety policy.

3.3 ROCK EXCAVATION:

A. Limited geotechnical information was used to determine rock elevations shown on the drawings.

B. The Contractor to remove all rock required installing utilities and all other elements shown on the drawings. Rock excavation shall be considered either mass rock or trench rock excavation.

C. All rock excavation will be conducted in conformance with these specifications. The contractor shall remove rock by means of hoe ram or ripping when within 10' of existing foundations and in conformance with these specifications, to remove rock and earth to the grades shown on the plans. No blasting will be permitted within 10' of the existing building.

D. During grading operations, maintain site drainage systems and siltation control systems to prevent erosion, sedimentation, or other damage.

3.4 TRENCH EXCAVATION:

A. Trench excavation shall conform to Section 2.05.03 of the 817 Standard State Specifications.

B. Cut trenches sufficiently wide to enable installation of materials and to allow inspection. Slope banks to angle of repose or install shoring where needed.

C. Excavate trenches to depth indicated or required to establish indicated slope and invert elevations.

D. Unless otherwise shown, separate trenches for each utility shall be provided. Lay piping in open trench. Under no circumstance shall the utility trench prohibit access for fire-fighting apparatus.

E. Grading trench bottoms: The bottom of the trenches shall be graded evenly to insure uniform bearing for full length of all pipes. Pipe bells should be fully bedded. Excavate to at least 6" below the pipe.

F. Hand trim for bell and spigot pipe joints.

G. The Contractor shall keep trenches free from standing water at all times. All necessary well pointing and/or pumping shall be performed and maintained at the Contractor's expense.

3.5 INSTALLATION AND BACKFILL:

A. Notify Owner’s Representative when excavations have reached required subgrade elevations. When the Owner’s Representative determines that unforeseen unsatisfactory soil is present as defined earlier, continue excavation and place with compacted granular fill material as directed.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Owner’s Representative at no additional cost to the Owner.

C. Procedures for placing granular fill and backfill shall conform to 817 Section 2.16. Granular fill and backfill shall be compacted to 95% modified proctor density as defined by ASTM D1557.

D. Subgrade beneath Granular fill should be compacted to 95% modified proctor density. Compact subgrade in accordance with Articles 2.09.03.

E. Fills and backfills where paved, or fills not otherwise specified, shall be compacted in 6" lifts to 95% modified proctor density.

F. All fill material shall be placed and compacted "in-the-dry" (shall not be compacted during unsuitable weather conditions).

G. The Contractor shall not place a layer of compacted fill on snow, ice, or soil that was permitted to freeze prior to compacting. Removal of these unsatisfactory materials will be required as directed by the Owner.

H. Compacted fill shall not be placed when temperatures are below freezing.

I. Use hay bales and silt fences for erosion protection and for preventing siltation of catch basins.

J. Processed Subbase for bituminous concrete pavements shall be placed in two courses and shall be done in accordance with Section 3.04 of the CONNDOT Specification 817.

L. Under structures, slabs, and pavements, compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent maximum density.

3.6 PLACEMENT OF GRANULAR AND STRUCTURAL FILL MATERIALS:

A. Gravel and structural fill shall be a minimum of 8" deep and shall extend to undisturbed soil at all locations.

B. Installation shall be in layers no more than 8" deep for material compacted by 10-ton vibratory rollers and not more than 4" deep for material compacted by hand-operated tampers.

C. Material shall be compacted to a minimum of 95% optimum density as determined by the laboratory tests. All areas not meeting the required density shall be recompacted, at the Contractor's expense, until the required density is achieved.

D. Granular and structural fill shall be placed in the following locations:

1. Beneath exterior equipment slabs and entrance platforms
2. All other areas specifically noted on the drawings

E. When a compacted drainage course is indicated to be 8 inches thick or less, place material in a single layer. When indicated to be more than 8 inches thick, place material in less than 3 inches in thickness when compacted. Each layer shall be compacted to 95% of modified optimum density as achieved by AASHTO Method T180.

F. Gravel and structural fill shall be compacted at moisture content, which will allow proper compaction. Gravel and structural fill shall not be placed where standing water is present.

G. Gravel and structural fill shall be recompacted where disturbed by installation of pipes, conduits, etc. Compaction shall be performed so as not to damage the installed items. The excavation and recompaction described above is included in the Contract.

H. Grading Surface of Fill Under Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation, provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.

I. Protect all compacted gravel and structural fill from saturation with excess moisture and from freezing. Any material that loses its required density due to excess moisture or freezing shall be removed, replaced, and compacted at the Contractor's expense.

J. Do not backfill against foundation walls until walls have been adequately braced. Where backfill occurs on both sides of wall, keep levels of fill equal on each side at all times.

3.7 UTILITY TRENCH BACKFILL:

A. Place and compact bedding course on rock and other underlying bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Place and compact trench backfill in accordance with Article 6.51.03 of the 817.

C. Coordinate backfilling with required utilities testing.

D. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8 SCHEDULE OF LOCATIONS OF FILL AND BACKFILL MATERIALS:

A. All material to be placed within the limits of the foundation, including gravel required beneath interior slabs on ground, under utility lines, and other areas where noted: gravel and structural fill, compacted to 95 percent.

B. Exterior side of foundation walls and retaining walls; subsoil, earth fill, or gravel and structural fill to subgrade elevation; compacted to 95 percent, unless specified otherwise.

3.9 GRADING:

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with the compaction requirements and grade to profiles, lines and elevations shown on the plans. Provide a smooth transition between existing adjacent grades and proposed grades. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

B. Site grading: Slopes grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or unpaved areas: Plus or minus 1 1/4 inches
2. Walks: Plus or minus 1 inch
3. Pavements: Plus or minus 1/2 inch
4. Grading inside building lines: Plus or minus 1/2 inch when tested with a 10-foot straightedge.

3.10 TESTING:

A. Field density tests will be performed by a qualified laboratory and paid for by the Owner.

B. The Contractor shall give the Owner's Representative 24 hours notice when each layer of fill is in place and ready for testing so that the Owner's Representative can observe field-testing.

C. At the direction of the Owner's Representative, all required re-testing (in case of failure) to meet specified density shall be at the Contractor's expense.

D. Compaction of fill materials shall conform to Section 2.02.03-6 State Specifications. Test shall conform to AASHTO T-180 Method D, except that the molds used shall be 6.11" high. Compaction to 95% maximum density is required in all areas, except landscaped areas, where only 90% compaction is required. In areas receiving more than 3 feet of fill or backfill, each 3-foot portion of depth shall be tested separately. All areas receiving fill or backfill are subject to testing.

End of Section 31 00 00

SECTION 31 10 00 – SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY:

A. Provide all labor, materials and equipment required to perform the work called for in this section of the Specification, or as shown on the drawings, including but not necessarily limited to the following:

1. The clearing of the ground of trees, stumps, brush, rubbish, and all objectionable material within the excavation, embankments and fill areas as indicated on the plans, or as directed.
2. Clear site of plant life and grass as indicated on the Drawings and as necessary to complete the work.
3. Remove root systems of trees and shrubs in areas cleared.
4. Removal of all existing bituminous concrete, concrete, and footings from within the excavation, embankments, and fill areas as indicated on the plans, or as directed.
5. Protection of existing trees that are to remain.
6. Protection of all site elements to remain including but not limited to railings, utilities and all other items identified on the drawings.
7. Installation of construction fencing, gates, and all other materials required to secure the construction site.
8. Disposal of debris off site.
9. Stripping and stockpiling existing topsoil.
10. Layout of all work/improvements.

B. Related work:

1. Section 31 23 00 - "Excavation and Fill"
2. Section 32 12 16 - "Bituminous Asphalt Concrete Paving"
3. Section 31 25 00 - "Stormwater and Pollution Control Plan"

1.3 SUBMITTALS:

A. The Contractor shall submit for review a detailed Sequence of Construction Plan for all construction that differs from the guidelines set forth in the Contract Documents or if not completely defined in the Contract Documents to allow for Contractor flexibility. Sequence of Construction Plan shall include provisions for Emergency Operations due to weather, or any other site emergency. No work shall be allowed until Sequence of Operations plan is approved by the Owner's Representative and the Engineer.

1.4 REGULATORY REQUIREMENTS:

A. Conform to applicable local, state, and federal regulations for disposal of debris.

B. Burning of debris will not be allowed.

C. Disposal of stumps on site will not be allowed.

D. The Contractor shall provide written documentation of compliance with all disposal regulations.

1.5 JOB CONDITIONS:

A. Peripheral areas outside of the Contract Limits shall not be disturbed or used for storing materials without authorization of the Owner's Representative.

B. Any damage to existing plant material or other improvements is the responsibility of the Contractor and shall be repaired or replaced immediately.

C. Topsoil stockpile areas must be approved by the Owner's Representative prior to placement of topsoil stockpiles.

PART 2 - PRODUCTS

2.1 TREE PROTECTION FENCE (if necessary):

A. Fence shall be 4 feet high "Safety Barricade" fencing.

1. Color: Orange.
2. Top tension rope: 3/8" braided nylon/polypropylene rope.

B. Posts shall be heavy gauge steel posts, six feet long.

2.2 TEMPORARY CHAIN LINK FENCING:

A. Unless otherwise indicated, type of temporary chain link fencing shall be Contractor's option. Following types are acceptable:

1. New materials or previously used salvaged chain link fencing in good condition.
2. Posts: Galvanized steel pipe of diameter to provide rigidity. Post shall be suitable for setting in concrete footings, driving into ground, anchoring with base plates, or inserting in precast concrete blocks.
3. Fabric: Woven galvanized steel wire mesh. Provide in continuous lengths to be wire tied to fence posts or prefabricated into modular pipe-framed fence panels.

B. Gates: Provide personnel and vehicle gates of the quantity and size indicated on the Drawings or required for functional access to site.

1. Fabricate of same material as used for fencing.
2. Vehicle gates:
   a. Minimum width: 20 feet to allow access for emergency vehicles.
   b. Capable of manual operation by one person.

PART 3 - EXECUTION

3.1 GENERAL:

A. Conduct site clearing, demolition and preparation to ensure minimum interference with roads and adjacent property owners and as required by the Owner.

B. Refer to Construction Documents for Construction Phasing and requirements and limitations on site clearing and grubbing.

C. All sedimentation control devices as shown on the plans, or as directed, shall be installed prior to any excavation activities or stump removal. Construction methods shall conform to article 2.19.03 of the Form 817. See Section 31 25 00 of the specifications.

3.2 PREPARATION:

A. Verify that existing plant life designated to remain is tagged or identified.

B. Flag limits of clearing for review by the Engineer prior to the start of any construction.

C. Identify required lines, levels, contours, and datum.

D. Identify known underground utilities. Stake and flag locations.

E. Identify and flag surface and aerial utilities.

F. Notify the appropriate utility authority to remove and relocate utilities.

G. Maintain and protect existing utilities remaining which pass through work area.

3.3 PROTECTION:

A. Identify and protect utilities that are to remain.

B. Protect plant growth and features remaining as final landscaping. Minimum protection includes the installation of orange construction fencing at the limits of the canopy of existing trees. Other measures shall be as directed by the Owner.

C. Protect control points, benchmarks, and existing work from damage or displacement.

D. Any and all measures taken to protect the existing site features, either described in these documents and Contract Drawings or as directed by the Owner, shall be included in the cost of the work

E. Protect above and below grade utilities which are to remain.

F. Repair immediately any damage done to tree crowns or root systems.

3.4 CLEARING AND GRUBBING:

A. Install erosion controls prior to any stump removal. Completely remove stumps, roots, and other debris protruding through ground surface.

B. Clear areas required for access to site and execution of the work.

1. Limits of Clearing and Grubbing shall be restricted as indicated on the drawings and as required by regulatory agencies.

C. Remove trees and shrubs within marked areas and as shown on the Drawings. Grub out stumps, roots, and surface rock to a depth of 3 feet below any subgrade.

1. Use only hand methods for grubbing inside drip line of trees indicated to remain.

D. Clear undergrowth and deadwood, without disturbing subsoil.

1. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

3.5 REMOVAL AND DISPOSAL:

A. All debris, trees, shrubs, brush, stumps, roots, and grass cleared and grubbed shall be removed and disposed of in accordance with all local, State and Federal regulations.

B. Burning and/or burial of cleared and grubbed material on the site shall not be permitted.

C. Contractor shall provide written documentation of proper disposal of all cleared and grubbed material and compliance with all applicable regulations.

3.6 "CALL BEFORE YOU DIG":

A. Contractor shall notify "Call Before You Dig" (CBYD) 8-1-1 a minimum 48 hours prior to start of construction and as necessary thereafter for the duration of the project. In the event CBYD in unable to complete this work it shall be the Contractor's responsibility to private utility locating company at no additional expense to the Owner.

3.7 STRIPPING AND STOCKPILING TOPSOIL:

A. Topsoil is defined as friable loam surface soil. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, without weeds, roots and other objectionable material.

B. Contractor shall confirm the approximate quantity to be stripped and overall quality of topsoil to be stripped and shall review with the owner's Representative prior to proceeding with work.

1. Topsoil test results on topsoil to be stripped shall be delivered to the Owner's Representative to determine acceptability of topsoil for reuse. See Section 32 91 19 Topsoil for specific testing requirements.

C. Strip topsoil to full depths encountered in a manner to prevent intermingling with the underlying subsoil or other objectionable material.

1. Prepare the areas of existing loam so as to provide clump free topsoil. Use a sod cutting rototiller or other approved method.

2. Where trees are indicated to be left standing, hold topsoil stripping a sufficient distance away to prevent damage to the root system.

D. Stockpile topsoil in storage piles constructed to freely drain surface water. Generally, topsoil is to be stockpiled as indicated on the Drawings.

E. Topsoil stockpiles shall be immediately seeded with 3 pounds of perennial ryegrass per 1,000 square feet to prevent erosion.

F. Upon completion of the job, any excess topsoil, present, shall remain the property of the Owner. The Contractor shall haul all excess topsoil to a location designated by the Owner, at no additional cost to the Owner.

3.8 FIELD QUALITY CONTROL AND ENGINEERING:

A. All subgrades must be observed and approved by the Engineer prior to fill placement. Sufficient time must be given to the Engineer to observe and perform any necessary tests on the subgrade.

B. The Contractor shall provide all offsets and other construction reference points necessary to establish and maintain location and elevation of all proposed improvements as shown on the Drawings and as field approved by the Owner's Representative during construction.

C. The Contractor, at his own expense, shall do all engineering required for establishing grades, lines, levels, dimensions and reference points for all trades; shall be responsible for maintaining bench marks and other survey marks, and shall replace as directed, any bench marks which have been disturbed or destroyed.

D. The Contractor shall compare all grades, lines, levels and dimensions as shown on the Drawings and actual site conditions, and shall promptly report to the Owner, before commencing work, any inconsistencies he may discover.

E. Contractor shall provide as-built survey of each phase of grading as noted below. Contractor shall not proceed with the subsequent phase without approval from the owner's representative. As-built survey shall be conducted in a grid of not more than 40 ft. on-center in each direction.

1. Subgrade prior to placement of fill
2. Gravel/sand fill prior to placement of topsoil
3. Topsoil prior to seeding

3.9 REMOVAL OF BITUMINOUS AND CONCRETE SURFACES:

A. Sawcut existing bituminous asphalt pavements to the lines indicated on the Contract Drawings. Edges shall be neat and straight. Contractor shall sawcut and remove the surface course of pavement to provide a 1-foot overlap.

B. Sawcut existing concrete surfaces as indicated on the drawings. Sawcuts shall be made at the next nearest joint.

C. Protect existing utilities, manhole covers, valve box covers, lighting, clean-outs, handholes, drainage structure tops, etc. Contractor shall provide all necessary shoring and bracing as may be required to protect and support the existing utilities to remain. Contractor shall replace at his own expense any utilities damaged as a result to this work.

3.10 LAYOUT OF TEMPORARY FENCING:

A. Installation of temporary fencing shall not deter or hinder access to existing and any hose connections and fire hydrants.

1. Maintain 3 feet diameter clear space around fire hydrants.
2. Where fire hydrant or hose connection is blocked by fencing, provide access gate.

B. Access: Provide gates for personnel, delivery of materials, and access by emergency vehicles.

C. Field verify locations with the Owners representative.

3.11 INSTALLATION OF TEMPORARY FENCING:

A. Chain link posts:

1. Space at 10 feet maximum.
2. Drive posts, set in holes and backfill, or anchor in precast concrete blocks.
3. For soft and unstable ground conditions, cast concrete plug around post.
4. Posts over pavement: Use steel post plates or precast concrete blocks.
5. Gate posts: Use bracing or concrete footings to provide rigidity for accommodating size of gate.

B. Fabric: Securely attach to posts.

C. Gates: Install with required hardware.

D. Plastic mesh fencing: Space steel support posts to ensure mesh remains vertical and at proper height. Securely tie mesh to posts.

3.12 MAINTENANCE AND REMOVAL OF TEMPORARY FENCING:

A. Maintain fencing in good condition. If damaged, immediately repair.

B. Remove temporary fencing upon completion of work or when no longer required for security or control. Backfill holes and compact. Holes in pavement shall be surfaced to match existing paving. Repair damage caused by installation of temporary fencing.

3.13 DISPOSAL OF WASTE MATERIALS:

A. Burning and Burial: Burning and burial are not permitted.

B. Clean up: Remove materials and debris from site preparation work as it accumulates.

1. Do not place or store materials and debris within the limits of any existing street, public right-of-way or roadway.
2. Parking, loading, and operation of trucks, dumpsters, etc. on existing highway and streets shall be governed by existing laws, ordinances, and regulations.

C. Disposal of Debris: Remove waste materials and unsuitable and excess topsoil from Owner's property and dispose of off-site legally and in a manner satisfactory to State, County, or local authorities having jurisdiction.

End of Section 31 10 00

SECTION 31 11 00 – SITE PREPARATION AND DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY:

A. Provide all labor, materials and equipment required to perform the work called for in this section of the Specification, or as shown on the drawings, including but not necessarily limited to the following:

1. Removal of all existing concrete and bituminous concrete from within the limits of trench excavation as indicated on the plans, or as directed.
2. Removal of existing site features as indicated on the drawings.
3. Protection of all site elements to remain including but not limited to railings, utilities and all other items identified on the drawings.
4. Provide temporary utility services as indicated on the drawings or as directed.
5. Provide temporary surface treatments such as pavement and walkways as shown on the drawings or as directed.

B. Related work:

1. Division 02 Section “Maintenance and Protection of Traffic”
2. Division 31 Section "Trenching and Backfilling"
3. Division 3 Section "Storm Water Pollution and Control Plan"
4. Division 32 Section "Bituminous Asphalt Concrete Paving"

1.3 SUBMITTALS:

A. Schedule:

1. Submit two copies of proposed methods and plan of operations for demolition of existing utilities to the Owner for review prior to the start of work. Include in the plan the coordination for shut-off, capping, and continuation of utility services as required.
2. Submit copies of all permits required for utility demolition work and transporting debris including certificates for severance of utility service.

B. The Contractor shall submit for review a detailed Sequence of Construction Plan for all construction that differs from the guidelines set forth in the Contract Documents or if not completely defined in the Contract Documents to allow for Contractor flexibility. Sequence of Construction Plan shall include provisions for Emergency Operations due to weather, or any other site emergency. No work shall be allowed until Sequence of Operations plan is approved by the Owner's Representative and the Engineer.

1.4 QUALITY ASSURANCE:

A. Codes and Regulations: Work shall be performed in strict accordance with the terms and conditions of all current Municipal and State statutes including OSHA. It shall be the Contractor's responsibility to determine all such statutes, codes, and regulations that are applicable or otherwise govern the performance of the work.

B. The Contractor shall obtain and pay for all permits, fee, and licenses required to perform the work.

1.5 JOB CONDITIONS:

A. Protection:

1. Prevent movement or settlement of adjacent structures. Provide and place bracing, shoring and underpinning and be responsible for safety and support of structures. Assume liability for such movement, settlement, damage, or injury. Provide services of registered Structural Engineer to design bracing, shoring, and/or underpinning if this work is required.
2. Cease operations and notify Architect/Engineer immediately if safety of adjacent structures appears to be endangered. Take precautions to properly support structures. Do not resume operations until safety is restored.
3. Prevent movement, settlement, or collapse of adjacent services, sidewalks, driveways, and trees. Assume liability for such movement, settlement, or collapse. Promptly repair damage at no cost to the Owner.
4. Provide, erect, and maintain street boardings, sidewalk sheds, barricades, lighting and guardrails as required to protect general public, workers, and adjoining property.

B. Maintaining Traffic:

1. Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
2. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Explosives: The use of explosives will not be permitted.

PART 2 – PRODUCTS - Not used.

PART 3 - EXECUTION

3.1 GENERAL:

A. Conduct site demolition and preparation to ensure minimum interference with roads and adjacent property owners and as required by the Owner.

B. Refer to Construction Documents for Construction Phasing and requirements and limitations on site clearing and grubbing.

C. Prior to any excavation, the Contractor shall notify all affected utilities in accordance with Public Act 77-350 ("Call Before You Dig": 811).

D. All sedimentation control devices as shown on the plans, or as directed, shall be installed prior to any excavation activities or stump removal. Construction methods shall conform to Article 2.19.03 of the Form 817. See Section 312500 of the specifications.

E. Disposal of excavated material shall be in accordance with Federal, State and local regulations.

F. Excavate material, as required.

G. Existing trees that are to remain shall be adequately protected to ensure that they are not damaged.

H No burning of material will be allowed.

I. Existing bituminous and concrete pavement to remain shall be saw-cut in a neat line.

J. Contractor shall secure site at the end of each day and at the end of each week. No open trenches, excavations shall be allowed. At the end of each week the Owner's Representative shall complete an inspection of the site including security, erosion controls, and any other construction feature. The Contractor shall make any required modifications at no cost to the Owner and to the satisfaction of the Owner's Representative.

K. During the progress of the work, keep all adjacent sidewalks, drives, and streets clean and free of dirt and debris.

3.2 HAZARDOUS MATERIAL AND WASTE CONTROL:

A. Excavation and disposal of contaminated, polluted, or "environmentally compromised" materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated polluted or "environmentally compromised" water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications.

End of Section 31 11 00

SECTION 31 23 00 – EXCAVATION AND FILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to work of this Section.

B. All related Specification Sections shall be used in conjunction with this Section.

1.2 SUMMARY:

A. Provide all labor, materials, necessary equipment and services to complete the work called for in this Section or as shown on the plans, including but not necessarily limited to the following:

1. Rough and finish grading.
2. Excavating, backfilling and compacting for structures.
3. Addition of processed aggregate base or borrow (if required), and disposal of unsuitable or excess materials.
4. Structural backfill under slabs on grade and against foundation walls.

B. Related Work: The following sections contain requirements that may apply to this section:

1. Section 31 10 00 - “Site Clearing
2. Section 31 25 00 - "Stormwater Pollution and Control Plan (SWPCP)"

1.3 EXCAVATION CLASSIFICATIONS:

A. Earth excavation or "excavation" consists of removal of materials encountered to the subgrade elevations indicated and subsequent reuse or disposal of the materials removed. All excavation is classified as earth excavation unless it otherwise meets the classifications provided below for unauthorized excavation, additional excavation, or rock excavation.

B. Unauthorized Excavation:

1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at Contractor's expense.

C. Additional Excavation:

1. When excavation has reached required subgrade elevations, notify the Engineer who will make an inspection of conditions.
2. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by the Engineer.
3. Removal of unsuitable material as directed and its replacement with suitable material will be paid for under the unit rate bid for this classification.

1.4 SUBMITTALS:

A. General: Refer to Division I for Submittal Requirements.

B. Laboratory and field test results including on-site and borrow topsoil analysis, soil material gradation, Modified Proctor, and compaction test results. Cost of testing shall be the responsibility of the Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Topsoil Suitable for Reuse: Excavated material not to contain materials harmful to plant life, to be clean, fertile and friable, well draining, natural sandy loam. All topsoil shall be free of roots, sticks, rocks larger than one inch, subsoil, weeds, debris and other deleterious material prior to excavating material to be reused as topsoil. The material shall have demonstrated by the occurrence upon it of healthy plant growth that it is of good quality and free draining. Topsoil shall be uniform in quality and texture and contain organic matter and mineral elements necessary for sustaining healthy plant growth. Topsoil stockpiled for reuse shall be screened prior to placement unless otherwise approved by the Engineer.

1. Topsoil shall have the following optimum ranges unless otherwise approved by the Engineer.

Organic content	3-20% (By loss of ignition at 375 C method of testing)
pH	6.0 – 8.0

2. Nutrient levels shall be achieved by the Contractor's addition of amendments to the topsoil to meet the optimum nutrient levels specified in the testing laboratory report for each crop/plant to be installed.

3. Topsoil shall meet the USDA Soils Textural Classification percentages of sand, silt, and clay for "sandy loam" or "loam" classification.
4. Topsoil shall be completely free of any toxic chemical, hazardous waste and any material or condition that would prevent the establishment of a suitable lawn and/or playing fields.

B. Subsoil Suitable for Reuse: Material used for general filling outside of limits of pavements may be either approved material available from excavation on-site or approved material, obtained from off-site, certified to conform to the following grain-size gradation:

Square Mesh Sieve	% Passing (by Weight)
3 ½"	100
2"	90
¼"	30-80
#40	5-30
#100	0-15

It shall be clean, free of clay and organic material, and capable of satisfactory compaction. If sufficient approved on-site material is not available to meet grading requirements indicated, Contractor shall provide additional approved off-site material at no extra cost to Owner.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Identify required lines, levels, contours, and datum.

B. Identify known underground utilities (if necessary). Stake and flag locations.

C. Identify and flag surface and aerial utilities (if necessary).

D. Notify the appropriate utility authority to remove and relocate utilities (if necessary).

E. Maintain and protect existing utilities remaining which pass through work area (if necessary).

3.2 PROTECTION:

A. Protect trees, shrubs, lawns, and other features remaining as a portion of final landscaping.

B. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from equipment and vehicular traffic.

C. Protect above and below grade utilities which are to remain.

D. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation.

E. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

F. Notify Engineer of unexpected subsurface conditions such as rock if encountered. Discontinue affected work in area until notified to resume work.

G. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

H. Grade excavation top perimeter to prevent surface water runoff into excavation.

I. Maintain bottom of all excavations stable, dry, and free of water on a 24-hour basis.

3.3 MAINTAIN ROADS PASSABLE:

A. Contractor shall maintain access to the park during construction.

3.4 DUST CONTROL:

A. During the progress of work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of water as necessary, so as to minimize the creation and dispersion of dust. If the Engineer decides that it is necessary to use calcium chloride for more effective dust control then the Contractor shall furnish and apply the material as directed.

B. Calcium chloride shall be commercial grade, furnished in 100-pound, 5-ply bags, stored under weatherproof cover and stacked alternately for ventilation. Application for dust control shall be at the rate of about 1/2 pound per square yard per application, unless otherwise directed by the Engineer.

3.5 EXCAVATION:

A. Excavate topsoil and subsoil required for underground structures, construction operations, and other work.

B. Remove all muck, peat and other unsuitable bearing material from areas where structures are to be located. If unsuitable material exists at limits of excavation shown on Drawings, obtain approval of Engineer prior to removal of material. Unauthorized excavation of unsuitable material will not be considered for payment.

C. Machine slope banks to angle of repose or less until shored.

D. Excavation generally shall not interfere with normal 45° bearing splay of any foundation.

E. Hand trim excavation and leave free of loose matter.

F. Correct unauthorized excavation at no additional expense to the Owner with material approved by the Engineer.

G. Fill over-excavated areas under structure bearing surfaces with structural fill in accordance with direction by the Engineer.

H. Stockpile excavated material to be reused in area designated on site and remove excess or unsuitable subsoil not being reused from site.

I. Maintain bottom of all excavations stable, dry, and free of water on a 24-hour basis.

J. Excavate to the lines and grades indicated, and deeper as required to reach suitable bearing soil as judged by the Engineer. The excavation shall be made deeper in areas where the subgrade is judged by the Engineer to have inadequate bearing capacity.

K. Conduct unclassified excavation using appropriate methods and equipment in sufficient quantity and sizes to perform the work as specified and as shown on the Drawings.

L. Adhere to specified restrictions for excavation and removal of buried structures.

M. Carry out excavation in such a manner that damage to adjacent roads, structures, and utilities is prevented.

N. Control the inflow of water into excavations by acceptable construction de-watering methods and procedures. Control the inflow of water to prevent loss of materials from outside the limits of excavation.

O. Prevent disturbance to all soil subgrades.

P. Remove unsuitable and excess suitable excavated material from the excavation and site promptly. Do not stockpile excavated material immediately outside the site limits.

Q. Limits of the excavation shall allow for adequate working space for installing forms and as required for safety of personnel.

R. Remove unstable bottom material. Remove large stones, boulders, debris, and unsuitable soil from excavation bottoms.

S. Excavation for the convenience of the Contractor shall conform to limits acceptable to the Engineer and shall be at no additional expense to the Owner.

T. Contractor shall provide 8-inches of 3/8" crushed stone at bottom of excavations in water.

3.6 SUBSURFACE OBSTRUCTIONS:

A. All buried structures shall be removed in confined excavations as general excavation proceeds. Do not excavate for buried structure removal below subgrade elevations unless otherwise directed by the Engineer.

B. Buried structures which extend below foundation subgrade elevations shall be cut off and left in place below the subgrade elevation, except as directed by the Engineer. If the buried structures directly interfere with a foundation support location, immediately notify the Engineer who will determine whether the buried structures should be removed or left in place. The Contractor will be paid for removal of buried structures encountered below subgrade elevations only when removal of the buried structures is directed by the Engineer.

C. Buried structures below subgrade elevations which are removed by the Contractor without being directed by the Engineer to do so shall be backfilled with lean concrete or properly compacted granular fill, unless otherwise directed by the Engineer, at no additional cost to the Owner.

3.7 EXCAVATION FOR STRUCTURES:

A. Excavation for structures shall be done to provide proper bearing for structures, to produce the proper grade and dimensions for finished construction, and in a satisfactory manner.

B. Excavation related to the structure shall be to the full depth required to provide suitable bearing material.

C. All traces of peat, loam or other unsuitable materials shall be fully removed.

D. Site preparation and other construction activities shall be conducted in a manner so as to minimize the disturbance of clay soils to remain in place, where applicable.

3.8 FIELD QUALITY CONTROL:

A. All subgrades must be observed and approved by the Engineer prior to fill placement. Sufficient time must be given to the Engineer to observe and perform any necessary tests on the subgrade.

B. The Contractor shall provide all offsets and other construction reference points necessary to establish and maintain location and elevation of all proposed improvements as shown on the Drawings and as field approved by the Owner's Representative during construction.

C. The Contractor, at his own expense, shall do all engineering required for establishing grades, lines, levels, dimensions and reference points for all trades; shall be responsible for maintaining bench marks and other survey marks, and shall replace as directed, any bench marks which have been disturbed or destroyed.

D. The Contractor shall compare all grades, lines, levels and dimensions as shown on the Drawings and actual site conditions, and shall promptly report to the Owner, before commencing work, any inconsistencies he may discover.

3.9 SUBGRADE PREPARATION AND PROTECTION:

A. General:

1. Complete the excavations to the required subgrade elevations allowing for subbase material, bedding layers, plus any additional depth required to accommodate particular requirements.
2. All subgrades must be observed and accepted by the Engineer prior to proof-rolling or placement of Compacted Granular Fill or any structure over subgrades.
3. Remove any additional materials below subgrade elevations, which are unsuitable where directed by the Engineer.
4. Proof-roll the exposed subgrade with a minimum 10-ton vibratory roller for a minimum of four (4) passes or as required by the Engineer.
5. Where directed by the Engineer, backfill all holes or voids encountered outside of minimum excavation limits with Compacted Granular Fill in layers not exceeding nine (9) inches measured before compaction and compact to 95 percent of maximum dry density (ASTM D1557) using appropriate compaction equipment.

3.10 PLACEMENT AND COMPACTION OF MATERIALS:

A. Backfill areas to contours and elevations.

B. Backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.

C. Protect fill area by grading to drain and providing a smooth surface which will readily shed water. Grade the surface of the areas in such a manner as to prevent ponding of surface water runoff in areas to receive compacted fill.

D. To the extent that it is practicable, each layer of fill shall be compacted to the specified density the same day it is placed.

E. Fill that is too wet for proper compaction shall be disced, harrowed or otherwise dried to a proper moisture content for compacting to the required density. If the fill material cannot be dried within 48 hours of placement, it shall be removed and replaced with drier fill.

F. If fill is too dry for proper compaction, the Contractor shall apply water to the fill uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.

G. Employ a placement method so not to disturb or damage work.

H. Maintain optimum moisture content of backfill materials to attain required compaction density.

I. Make changes in grade gradual. Blend slopes into level areas.

J. Remove surplus backfill materials from site and dispose of in an acceptable manner.

K. Leave stockpile areas completely free of excess fill materials.

L. Contractor shall be aware of existing conditions, including existing building construction, and shall choose compaction equipment and methods accordingly. Compaction adjacent to foundation walls shall be performed with walk behind plate compactor.

3.11 COMPACTION TESTING:

A. Compaction testing will be performed in accordance with ASTM D 1556, or D 2922 and the General Conditions.

B. If tests indicate work does not meet specified requirements, remove work, and replace at no cost to Owner.

C. Materials and operations shall be tested and inspected as work progresses. Failure to detect defective work shall not prevent rejections when defect is discovered.

D. To facilitate testing and inspection, the Contractor shall:

1. Furnish necessary labor to assist testing agency in obtaining and handling samples at the job site.
2. Contractor shall provide 48 hours notice to the Owner prior to testing.

E. Owner agrees to pay for the above tests with the exception of work that is found to be defective. Subsequent tests shall be taken and paid for by the Contractor.

3.12 TOLERANCES:

A. Top Surface of Backfilling: Plus or minus one inch.

End of Section 31 23 00

SECTION 31 23 16 – STRUCTURAL EXCAVATION AND FILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY:

A. Provide all labor, materials, necessary equipment and services to complete the work called for in this Section or as shown on the plans, including but not necessarily limited to the following:

1. Rough and finish grading.
2. Excavating, backfilling and compacting for structures. (All excavations for this project will be considered as unclassified excavation).
3. Addition of processed aggregate base or borrow (if required), and disposal of unsuitable or excess materials.
4. Structural backfill under slabs on grade and against foundation walls.
5. Geotextile (filter fabric).

B. Related Work: The following sections contain requirements that may apply to this section:

1. Division 3, Section "Cast-In-Place Concrete."

1.3 SUBMITTALS:

A. Submit for review sieve analysis of off-site borrow and all different fills for review. Provide test reports of existing material to determine if suitable for reuse.

B. Product data for the following:

1. Filter Fabric.

C. Submit one modified proctor density test for each fill type in accordance with ASTM Method T-180.

1.4 QUALITY ASSURANCE:

A. All work of this section shall be provided in accordance with the structural drawings which is considered to be part of this specification, the same as if fully set forth herein.

1.5 DEFINITIONS:

A. Excavation consists of removal of material encountered to subgrade elevations indicated and the reuse or subsequent disposal of excess materials removed. The classification for all excavations on this site shall be “unclassified” and shall include but not be limited to the removal of any and all earth, rock, and unsuitable material as required to construct the buildings and pavement to the lines and grades shown in the drawings at no additional cost to the Owner.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Owner's Representative. Unauthorized excavation, as well as remedial work directed by Owner's Representative, shall be at Contractor's expense.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify Owner's Representative, who will make an inspection of conditions. If the Owner's Representative determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Owner's Representative. The Contract Sum may be adjusted by an appropriate Contract Modification.

1. Removal of unsuitable material and its replacement as directed will be paid on the basis of Conditions of the Contract relative to changes in work.

D. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

E. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

F. Subbase Course: The layer placed between the subgrade and the base course in a paving system or the layer placed between the subgrade and surface course of a walk. Subbase Material: Gravel subbase material shall conform to the requirements of Section 2.12 of the Form 817. The minimum depth of subbase shall be as shown on

the drawings and the contractor shall add additional processed aggregate base material as required.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground.

H. Unsuitable Materials: ASTM D 2487 Soil Classification Groups:

SC: Clayey sands, sand-clay mixtures.

ML: Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity.

CL: Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.

OL: Organic silts and organic silty clays of low plasticity.

MH: Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.

CH: Inorganic clays of high plasticity, fat clays.

OH: Organic clays of medium to high plasticity, organic silts.

Pt: Peat and other highly organic soils.

SM: Silt soils

1.6 PROTECTION:

A. Underpin adjacent structures that may be damaged by excavation work, including service utilities and pipe chases.

B. Notify Owner's Representative of unexpected subsurface conditions and discontinue effected work in area until condition is resolved.

C. Protect bottom of excavations and soil adjacent to and beneath foundations against freezing when atmospheric temperature is less than 35°F.

D. Do not allow water to accumulate in 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, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

E. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to sedimentation pools. Do not use trench excavations as temporary drainage ditches.

F. Grade top perimeter of excavation to prevent surface water runoff into excavation.

G. Use hay bales and silt fences for erosion protection and for preventing siltation of catch basins.

1.7 SPECIAL REQUIREMENTS:

A. Before beginning work, the Contractor shall check, in the field, existing grades and layout as shown on the drawings and report any discrepancies that will affect the work of this contract to the Owner's Representative. Commencement of work will be implied to mean acceptance. No adjustments will be made for discrepancies discovered after work has begun.

B. The Contractor shall carefully protect all land monuments from disturbance or damage.

1.8 PROJECT CONDITIONS:

A. Site Information: No subsurface investigation reports were completed for this project.

B. Contractor shall be responsible to contact Call Before You Dig (CBYD), telephone 8-1-1, for information as to location of existing utilities and to obtain a permit number 48 hours before start of excavation. In the event CBYD is unable to locate the utilities it shall be the Contractor’s responsibility to hire a private utility location company at no additional cost to the owner.

1. 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 utility owner.
2. Do not interrupt existing utilities serving facilities occupied by owner or others, during occupied hours, except when permitted in writing by Owner's Representative and then only after acceptable temporary utility services have been provided.

3. Provide the Owner's Representative a 48-hour minimum notice and wait to receive written approval to proceed before interrupting and utility.

C. Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by State authorities.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. No on-site material may be used as controlled fill beneath the buildings or backfill for walls.

2.2 OFF-SITE MATERIALS:

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.

B. Granular Fill shall se a maximum 3 in. size for fill placed within 12 in. of concrete slabs and foundations.

C. Crushed or processed stone shall be as noted on the drawings and consist of sound, durable stone free of soft disintegrated pieces, mud, dirt, organic, or other injurious material.

D. Structural Backfill for the backfill of excavations for footings and walls, fill beneath slabs on grade and where indicated on the drawings shall conform to the following gradation:

Percent Passing	Sieve Size
100	3-1/2”
50-100	¾”
25-75	No. 4

The percent passing the No. 4 sieve shall have less than 15% passing the No. 200 sieve.

The material shall be compacted in lifts not exceeding 8 inches to 95% of the modified Proctor density.

Refer to the Structural Drawings. If a conflict arises between the information in this specification and that shown on the drawings, the drawings shall be held.

E. Geotextile (Filter Fabric) shall be MIRAFI 500X or equal. See structural drawings for additional information.

PART 3 - EXECUTION

3.1 GENERAL:

A. Stockpile excavated materials acceptable for backfill and fill where directed on the drawings. Place, grade, and shape stockpiles for proper drainage. Place erosion controls as required.

B. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

C. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill off-site in a legal manner at no expense to the Owner.

D. Excess material may be generated as a result of excavations and grading. All excess material shall be disposed of legally off-site at the Contractor's expense.

E. Site areas requiring new fill shall be stripped of all topsoil, organics, and soft yielding material prior to the depositing of fill material.

F. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding the project site and surrounding area. The Contractor shall not convey water to any area outside the project limits.

3.2 EXCAVATION:

A. Before starting excavation, establish location and extent of any underground utilities occurring in work area.

B. Excavations shall be carried to a suitable undisturbed subbase. This subbase shall be free of any soft or yielding material. Refer to structural drawings for additional information.

C. All excavations shall be made to the proper elevations and dimensions indicated on the drawings with proper allowance made for structural fill and erection of forms. All excavation where shoring is required must comply with OSHA shoring provisions and campus safety policy.

D. All existing fills, existing structures, and topsoil should be removed beneath the floors and be replaced with controlled fill conforming to section 2.2.D. There should be at least 18" of controlled fill beneath the floor placed to within 4" of the slab bottom. The final 4" layer directly beneath the floor slab should be with 3/8" crushed stone. A vapor retarder is required beneath the slab at grade floors. Compact existing natural soils or fill to 95% of the modified proctor density.

3.3 INSTALLATION OF BACKFILL:

A. Notify Owner's Representative when excavations have reached required subgrade elevations. When the Owner's Representative determines that unforeseen unsatisfactory soil is present as defined earlier, continue excavation and place with compacted granular fill material as directed.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Owner's Representative at no additional cost to the Owner.

C. Procedures for placing granular fill and backfill shall conform to the Geotechnical Report. Granular fill and backfill shall be compacted to 95% modified proctor density as defined by ASTM D1557.

D. Subgrade beneath Granular fill should be compacted to 95% modified proctor density. Compact subgrade in accordance with Articles 2.09.03.

E. Fills and backfills where paved, or fills not otherwise specified, shall be compacted in 8" lifts to 95% modified proctor density.

F. All fill material shall be placed and compacted "in-the-dry" (shall not be compacted during unsuitable weather conditions).

G. The Contractor shall not place a layer of compacted fill on snow, ice, or soil that was permitted to freeze prior to compacting. Removal of these unsatisfactory materials will be required as directed by the Owner.

H. Compacted fill shall not be placed when temperatures are below freezing.

I. Under footings, foundation bases or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete may be used to bring elevations to proper position, when acceptable to Owner's Representative.

J. Under structures, slabs compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent maximum density.

3.4 PLACEMENT OF GRANULAR AND STRUCTURAL FILL MATERIALS:

A. Gravel and structural fill shall be a minimum of 8" deep and shall also extend as required to undisturbed soil at all locations.

B. Installation shall be in layers no more than 8" deep for material compacted by 10-ton vibratory rollers and not more than 4" deep for material compacted by hand-operated tampers.

C. Material shall be compacted to a minimum of 95% optimum density as determined by the laboratory tests. All areas not meeting the required density shall be recompacted, at the Contractor's expense, until the required density is achieved.

D. Granular and structural fill shall be placed in the following locations:

1. Beneath exterior equipment slabs and entrance platforms
2. All other areas specifically noted on the drawings

E. When a compacted drainage course is indicated to be 8 inches thick or less, place material in a single layer. When indicated to be more than 8 inches thick, place material in less than 6 inches in thickness when compacted. Each layer shall be compacted to 95% of modified optimum density as achieved by AASHTO Method T180.

F. Gravel and structural fill shall be compacted at moisture content, which will allow proper compaction. Gravel and structural fill shall not be placed where standing water is present.

G. Gravel and structural fill shall be recompacted where disturbed by installation of pipes, conduits, etc. Compaction shall be performed so as not to damage the installed items. The excavation and recompaction described above is included in the Contract.

H. Grading Surface of Fill Under Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation, provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.

I. Protect all compacted gravel and structural fill from saturation with excess moisture and from freezing. Any material that loses its required density due to excess moisture or freezing shall be removed, replaced, and compacted at the Contractor's expense.

J. Do not backfill against foundation walls until walls have been adequately braced. Where backfill occurs on both sides of wall, keep levels of fill equal on each side at all times.

3.5 NOTIFICATION:

A. When ledge rock or boulders are encountered, the material shall be uncovered and the Engineer notified. The Contractor shall be responsible for and provide the Engineer with cross sections of the ledge rock surface. The Engineer shall be notified in advance as to when the cross section of ledge is to be made. If the Contractor uncovers ledge, but fails to notify the Engineer, the Contractor shall have no right of claim to any classification other than that allowed by the Engineer.

B. The average end area method shall be used in the computation of volumes wherever practicable.

3.6 LIMITS OF EXCAVATION IN ROCK:

A. Excavation in rock shall be performed, unless otherwise indicated on the Plans directed, so that no projection shall come within vertical planes 12 inches outside of the structure being built, 12 inches below the bottom of the structure base slab and footings, or as shown on the Drawings. Where excavation is carried beyond the above determined limits, the additional space shall be refilled at the Contractor's expense with concrete or other selected material, as directed by the Engineer.

3.7 ROCK REMOVAL:

A. NO BLASTING WILL BE ALLOWED ON THIS PROJECT.

B. Rock removal shall be conducted using mechanical means, including hoe rams, rippers, and or other hydraulic equipment.

C. Over excavation beyond the limits shown shall not be paid for but shall be at the Contractor's expense.

3.8 DISPOSAL AND REPLACEMENT OF ROCK:

A. Rock shall be considered unsuitable for backfilling and removed from the site.

B. Rock and boulders shall be replaced at no additional expense to the Owner with suitable material as specified above.

C. If rock below limits of excavation is caused by holes drilled too deep or any other circumstance due to excavation and if such shattered rock does not provided suitable foundation, the rock shall be removed and the excavation refilled with gravel at the expense of the Contractor. The gradation of gravel shall be as specified above.

3.9 TESTING:

A. Field density tests will be performed by a qualified laboratory and paid for by the Owner.

B. The Contractor shall give the Owner's Representative 24 hours notice when each layer of fill is in place and ready for testing so that the Owner's Representative can observe field testing.

C. At the direction of the Owner's Representative, all required re-testing (in case of failure) to meet specified density shall be at the Contractor's expense.

D. Compaction of fill materials shall conform to Section 2.02.03-6 State Specifications. Laboratory test to establish maximum density shall conform to AASHTO T-180 Method D, except that the molds used shall be 6.11" high. Field density tests shall be as specified by AASHTO T-191 or by use of a portable nuclear density testing device. Field density tests shall be taken at a depth equal to ½ the maximum depth of the lift tested. Compaction to 95% maximum density is required in all areas, except landscaped areas,

where only 90% compaction is required. In areas receiving more than 3 feet of fill or backfill, each 3-foot portion of depth shall be tested separately. All areas receiving fill or backfill are subject to testing.

3.10 HAZARDOUS MATERIAL AND WASTE CONTROL:

A. Excavation and disposal of contaminated, polluted, or "environmentally compromised" materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated, polluted, or "environmentally compromised" water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications.

End of Section 31 23 16

SECTION 31 23 19 – DEWATERING

PART 1 - GENERAL

1.1 SYSTEM PERFORMANCE REQUIREMENTS:

A. Dewatering shall include all necessary control and disposal of groundwater on a 24-hour basis during construction.

B. Dewatering shall include the lowering of the groundwater table to relieve any hydrostatic head that could cause a decrease in the stability of the excavated subgrade. It shall also include the intercepting of seepage, which could otherwise emerge from the slope or sides of excavations, which could cause a decrease in the stability of the excavated subgrade or the slopes or sides of the excavations.

C. Dewatering shall be performed during construction to temporarily protect against the following:

1. The loss of any material beneath the excavated subgrade or from the slopes or sides of the excavations or the movement of any fine particle materials from the soil.
2. Any increased vertical or lateral loads on the excavation support systems.
3. Any disturbance, rupture, instability, boiling or heaving of the bottom of excavated subgrade during:

    a. Excavation.
    b. Placement of foundation or bedding materials.
    c. Construction of slabs, footings and any other structures.
    d. Backfilling operations.

D. The Contractor is forbidden from discharging water collected from the dewatering operations directly into watercourses, wetlands areas, and storm drainage systems. As a result, the Contractor shall provide for methods, materials, and construction, to be approved by the Engineer and Owner, for collection and treatment of the dewatering operations discharge(s). At a minimum, these methods will include conveying the discharged water through a sedimentation system, appropriately sized for the operation, as described in Section 31 25 00 “Storm Water Pollution Control Plan” and indicated on the drawings.
If, in the sole opinion of the Engineer, the sedimentation system is inadequate, the contractor shall be required to provide dual compartment septic tank, appropriately sized for the operation, to which the dewatering water shall be directed.
In no case will discharge containing visible sediment, or other pollutants be allowed to discharge to wetlands areas or drainage systems. The proposal for treating the dewatering discharge water shall be prepared by a Connecticut Registered Professional Engineer.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to work of this Section.

B. Connecticut Department of Energy and Environmental Protection (CT DEEP) General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities.

C. 2002 Connecticut Erosion and Sedimentation Guidelines.

D. All related specification sections shall be used in conjunction with this section.

E. CONN DOT Form 817.

1.3 ADDITIONAL PROVISIONS:

A. Provide, operate, and maintain any dewatering system required to lower and control groundwater levels and groundwater hydrostatic pressure during the construction of the work, as required by this Section and the Contract Documents with no additional time allowed for the completion of the work.

B. Remove and dispose of water resulting from activities described in 1.1 C and 1.2 A and C above.

C. Remove dewatering systems and equipment when no longer required.

1. 4 SUBMITTALS:

A. Submit under provisions of Division 1.

B. DEWATERING PLAN: The Contractor shall submit plans for the proposed dewatering system to the Engineer for review. Dewatering system shall be designed by a Professional Engineer licensed to practice in the State of Connecticut for the drainage area being directed to the dewatering system and submitted for review. Sizes and locations shown on the plans are minimums.

PART 2 – PRODUCTS - Not Used.

PART 3 - EXECUTION

3.1 GENERAL PRACTICES:

A. The dewatering system shall be capable of developing an excavated subgrade relieved of any hydrostatic pressure that could cause a decrease in the stability of the excavated subgrade and which will provide the necessary groundwater control for the proper performance required for completion of the work.

B. The dewatering system shall not cause damage to newly constructed or existing properties, buildings, utilities and other work due to the loss of ground or support from incompletely drained soils or from removal of soil particles caused by the dewatering system.

C. Dewatering facilities shall be located only where they will not cause interference with work performed by others.

D. If the dewatering system utilized by the Contractor causes or threatens to cause damage to new or existing facilities, the dewatering system shall be removed and/or modified at no additional expense to the Owner.

E. Dispose of subsurface water collected in a manner that conforms to all applicable local and state ordinances, statutes and laws as well as Section 1.2 above.

F. Maintain continuous and complete effectiveness of the installation at all times.

G. Provide dewatering necessary to maintain the groundwater table a minimum of 2 feet below the bottom of excavated subgrade or the prevailing level of backfill as it is being placed. The groundwater table shall also be maintained at a level, which will not result in uplift pressure in excess of 80% of the downward pressure produced by the weight of the structure and any backfill in place.

3.2 JOB CONDITIONS:

A. Erosion Control: The Contractor shall provide adequate protection from erosion from any of the dewatering operations utilized during the course of the construction. Any damage, disruption, or interference to newly constructed work or existing properties, building, structure, utilities and/or other work resulting directly or indirectly from dewatering operations conducted under this Contract shall be remedied by the Contractor to the satisfaction of the Engineer, at no cost to the Owner.

B. Treatment of Dewatering Operations Discharges: It shall be the responsibility of the Contractor to provide such additional treatment as may be required to meet the provisions of the Contract. This may include the construction of sumps and/or settling basins, stone rip rap, silt fences or other the noted septic tankage requirements. They shall be provided and later removed and/or filled in with acceptable backfill material once they are no longer needed at no additional expense to the Owner.

3.3 HAZARDOUS MATERIAL AND WASTE CONTROL:

A. Excavation and disposal of contaminated, polluted, or “environmentally compromised” materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated, polluted, or “environmentally compromised” water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications.

End of Section 31 23 19

SECTION 31 23 33 – TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 RELATED DOCUMENT:

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY:

A. Provide all labor, materials, necessary equipment and services to complete the work called for in this Section or as shown on the plans, including but not necessarily limited to the following:

1. Excavating, backfilling and compacting for utilities. (All excavations for this project will be considered as unclassified excavation).
2. Addition of processed aggregate base or borrow (if required), and disposal of unsuitable or excess materials.
3. Granular fill for trench backfill.
4. Bank or crushed stone for use in utility trenches.
5. Geotextile (filter fabric).

B. Related Work: The following sections contain requirements that may apply to this section:

1. Division 31, Section 31 11 00 - "Site Preparation and Demolition."
2. Division 31, Section 31 23 16 - "Structural Excavation and Fill"
3. Division 31. Section 31 25 00 - "Storm Water Pollution Control Plan (SWPCP)".

1.3 SUBMITTALS:

A. Submit for review sieve analysis of off-site borrow and all different fills for review. Provide test reports of existing material to determine if suitable for reuse.

B. Submit one modified proctor density test for each fill type in accordance with ASTM Method T-180.

1.4 QUALITY ASSURANCE:

A. All work of this section shall be provided in accordance with the latest edition of State of Connecticut Department of Transportation Form 817 which is considered to be part of this specification, the same as if fully set forth herein.

1.5 DEFINITIONS:

A. Excavation consists of removal of material encountered to subgrade elevations indicated and the reuse or subsequent disposal of excess materials removed. The classification for all excavations on this site shall be “unclassified” and shall include but not be limited to the removal of any and all earth, rock, and unsuitable material as required to construct the buildings and pavement to the lines and grades shown in the drawings at no additional cost to the Owner.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Owner's Representative. Unauthorized excavation, as well as remedial work directed by Owner's Representative, shall be at Contractor's expense.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify Owner's Representative, who will make an inspection of conditions. If the Owner's Representative determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Owner's Representative. The Contract Sum may be adjusted by an appropriate Contract Modification.

1. Removal of unsuitable material and its replacement as directed will be paid on the basis of Conditions of the Contract relative to changes in work.

D. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

E. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

F. Subbase Course: The layer placed between the subgrade and the base course in a paving system or the layer placed between the subgrade and surface course of a walk.

G. Subbase Material: Gravel subbase material shall conform to the requirements of Section 2.12 of the Form 817. The minimum depth of subbase shall be as shown on

the drawings and the contractor shall add additional processed aggregate base material as required.

H. Unsuitable Materials: ASTM D 2487 Soil Classification Groups:

SC Clayey sands, sand-clay mixtures.
ML Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity.
CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
OL Organic silts and organic silty clays of low plasticity.
MH Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
CH Inorganic clays of high plasticity, fat clays.
OH Organic clays of medium to high plasticity, organic silts.
Pt Peat and other highly organic soils.
SM Silt Soils

1.6 PROTECTION:

A. Underpin adjacent structures that may be damaged by excavation work, including service utilities and pipe chases.

B. Notify Owner's Representative of unexpected subsurface conditions and discontinue effected work in area until condition is resolved.

C. Protect bottom of excavations and soil adjacent to and beneath foundations against freezing when atmospheric temperature is less than 35°F.

D. Do not allow water to accumulate in 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, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

E. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to sedimentation pools. Do not use trench excavations as temporary drainage ditches.

F. Grade top perimeter of excavation to prevent surface water runoff into excavation.

G. Use hay bales and silt fences for erosion protection and for preventing siltation of catch basins.

1.7 SPECIAL REQUIREMENTS:

A. Before beginning work, the Contractor shall check, in the field, existing grades and layout as shown on the drawings and report any discrepancies that will affect the work of this contract to the Owner's Representative. Commencement of work will be implied to mean acceptance. No adjustments will be made for discrepancies discovered after work has begun.

B. The Contractor shall carefully protect all land monuments from disturbance or damage.

1.8 PROJECT CONDITIONS:

A. Site Information: Data in subsurface investigation reports was used for the basis of the design and are available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

B. Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

C. Contractor shall be responsible to contact Call Before You Dig (CBYD), telephone 811, for information as to location of existing utilities and to obtain a permit number 48 hours before start of excavation.

1. 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 utility owner.
2. Do not interrupt existing utilities serving facilities occupied by owner or others, during occupied hours, except when permitted in writing by Owner's Representative and then only after acceptable temporary utility services have been provided.
3. Provide the Owner's Representative a 48-hour minimum notice and wait to receive written approval to proceed before interrupting and utility.

D. Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by State authorities.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.1 ON-SITE MATERIALS:

A. Existing site materials can be used for the following applications if in conformance with the applicable Section of the Specifications. The Contractor shall mix, pulverize, and add additional material as required to utilize material at no additional cost to the Owner.

2.2 OFF-SITE MATERIALS:

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.

B. Common Fill - Borrow shall comply with Article 2.07.02 of the CONN DOT Form 817.

C. Granular Fill shall comply with Article M.02.01 of the CONN DOT Form 817. Use a maximum 3 in. size for fill placed within 12 in. of concrete slabs or foundations.

D. Trench backfill under pavements shall consist of compacted gravel subbase and compacted processed base to the depths as shown on the plans. Compacted gravel subbase shall conform to Form 817, Article M.02.01. Compacted processed base shall conform to Form 817, Section M.05.01.

E. Processed or crushed stone shall conform to CONN DOT Form 817, Section M.02 for the size noted on the drawings and consist of sound, durable stone free of soft disintegrated pieces, mud, dirt, organic, or other injurious material.

F. Free-Draining Material shall conform to CONN DOT Form 817, Section M.02.07.

G. Geotextile (Filter Fabric) shall conform to Section 7.55 of the CONN DOT Form 817 and shall meet the following minimum requirements:

minimum fabric weight of 16 oz./sy
minimum grab tensile strength of 350 lbs
minimum puncture resistance of 195 lbs

2.3 ACCESSORIES:

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.

PART 3 - EXECUTION

3.1 GENERAL:

A. Stockpile excavated materials acceptable for backfill and fill where directed on the drawings. Place, grade, and shape stockpiles for proper drainage. Place erosion controls as required.

B. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

C. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill off-site in a legal manner at no expense to the Owner.

D. Excess material may be generated as a result of excavations and grading. All excess material shall be disposed of legally off-site at the Contractor's expense.

E. Site areas requiring new fill shall be stripped of all topsoil, organics, and soft yielding material prior to the depositing of fill material.

F. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding the project site and surrounding area. The Contractor shall not convey water to any area outside the project limits.

3.2 TRENCH EXCAVATION AND BACKFILL:

A. Trench excavation shall conform to Section 2.05.03 of the Form 817 Standard State Specifications.

B. Cut trenches sufficiently wide to enable installation of materials and to allow inspection. Slope banks to angle of repose or install shoring where needed.

C. Excavate trenches to depth indicated or required to establish indicated slope and invert elevations.

D. Unless otherwise shown, separate trenches for each utility shall be provided. Maintain ready access for fire-fighting apparatus.

E. Grading trench bottoms: The bottom of the trenches shall be graded evenly to insure uniform bearing for full length of all pipes. Excavate to at least 4" below the pipe. .

F. Place and compact bedding course on rock and other underlying bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Hand trim for bell and spigot pipe joints.

G. Place and compact trench backfill in accordance with Article 6.51.03 of the Form 817. Coordinate backfilling with required utilities testing.

H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

I. The Contractor shall keep trenches free from standing water at all times. All necessary well pointing and/or pumping shall be performed and maintained at the Contractor's expense.

J. The contractor shall reference the required utility service Gas Main – Construction standards for additional trenching and backfilling requirements for Gas Piping, valves, connections, etc.

3.3 NOTIFICATION:

A. When ledge rock or boulders are encountered, the material shall be uncovered and the Engineer notified. The Contractor shall be responsible for and provide the Engineer with cross sections of the ledge rock surface. The Engineer shall be notified in advance as to when the cross section of ledge is to be made.
If the Contractor uncovers ledge, but fails to notify the Engineer, the Contractor shall have no right of claim to any classification other than that allowed by the Engineer.

B. The average end area method shall be used in the computation of volumes wherever practicable.

3.4 LIMITS OF EXCAVATION IN ROCK:

A. Excavation in rock shall be performed, unless otherwise indicated on the Plans directed, so that no projection shall come within vertical planes 12 inches outside of the structure being built, 12 inches below the bottom of the structure base slab and footings, or as shown on the Drawings. In trenches, the rock shall be removed to the limits shown on the typical trench section. Where excavation is carried beyond the above determined limits, the additional space shall be refilled at the Contractor's expense with concrete or other selected material, as directed by the Engineer.

3.5 ROCK REMOVAL:

A. BLASTING WILL NOT BE ALLOWED ON THIS PROJECT.

B. Removal of rock shall be to the limits as shown on the contract drawings. Over excavation beyond the limits shown shall not be paid for but shall be at the Contractor’s expense.

3.6 DISPOSAL AND REPLACEMENT OF ROCK:

A. Rock shall be considered unsuitable for backfilling and removed from the site.

B. Rock and boulders shall be replaced at no additional expense to the Owner with suitable material as specified above.

C. If rock below limits of excavation is caused by holes drilled too deep or any other circumstance due to excavation and if such shattered rock does not provided suitable foundation, the rock shall be removed and the excavation refilled with gravel at the expense of the Contractor. The gradation of gravel shall be as specified above.

3.7 TESTING:

A. Field density tests will be performed by a qualified laboratory and paid for by the Owner.

B. The Contractor shall give the Owner's Representative 24 hours notice when each layer of fill is in place and ready for testing so that the Owner's Representative can observe field testing.

C. At the direction of the Owner's Representative, all required re-testing (in case of failure) to meet specified density shall be at the Contractor's expense.

D. Compaction of fill materials shall conform to Section 2.02.03-6 State Specifications. Laboratory test to establish maximum density shall conform to AASHTO T-180 Method D, except that the molds used shall be 6.11" high. Field density tests shall be as specified by AASHTO T-191 or by use of a portable nuclear density testing device. Field density tests shall be taken at a depth equal to ½ the maximum depth of the lift tested. Compaction to 95% maximum density is required in all areas, except landscaped areas, where only 90% compaction is required. In areas receiving more than 3 feet of fill or backfill, each 3-foot portion of depth shall be tested separately. All areas receiving fill or backfill are subject to testing.

3.8 HAZARDOUS MATERIAL AND WASTE CONTROL:

A. Excavation and disposal of contaminated, polluted, or "environmentally compromised" materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated, polluted, or "environmentally compromised" water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications.

End of Section 31 23 33

SECTION 31 25 00 – STORMWATER POLLUTION AND CONTROL PLAN (SWPCP)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY:

A. Provide all labor, materials, necessary equipment and services to complete the work called for in this Section or as shown on the plans, including but not necessarily limited to the following:

1. Slope protection and erosion control devices and measures as shown on the Drawings, around material stockpiles, and where directed by the Engineer.
2. Maintenance, repair and replacement of slope protection and erosion control devices and measures as required. One employee of the General Contractor shall be assigned to inspect the erosion control measures and to maintain or repair them as necessary. Such maintenance and repair shall take precedence over other work.
3. Removal of slope protection and erosion control devices and measures when no longer required.
4. Construction of temporary perimeter stone swales, sediment forebays, dewatering basins, sediment basin, and outlet structures.
5. Temporary seeding or vegetative cover.
6. Installation of anti-tracking pad.
7. Removal of collected sediment and debris.
8. Restoration of disturbed areas to finish surface indicated on Drawings.
9. Installation of permanent mulches.
10. Conformance to erosion notes on plans and Connecticut DEEP requirements.

B. Related Work: The following sections contain requirements that may apply to this section:

1. Division 31 Section 31 10 00 – “Site Clearing”
2. Division 32 Section 32 92 00 – “Lawns and Grasses”

1.3 REFERENCE STANDARDS:

A. Connecticut Department of Energy and Environmental Protection (CT DEEP), General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities. Issuance Date: August 21, 2013 Effective Date: October 1, 2013.

B. Form 817, State of Connecticut Department of Transportation, Standard Specifications for Roads, Bridges and Incidental Construction, 2016. Connecticut Guidelines for Soil Erosion and Sediment Control, the Connecticut Council on Soil and Water Conservation, 2002.

C. Connecticut Stormwater Quality Manual, 2004.

D. Connecticut Department of Transportation Drainage Manual, 2000.

E. Connecticut Department of Transportation Drainage Manual, 2000.

1.4 SEQUENCING/SCHEDULING:

A. Install all soil erosion and sediment control devices and measures prior to commencing construction. Install additional measures as required during construction and maintain such structures throughout construction period.

1.5 SUBMITTALS:

A. Submit under provisions of Division 1.

B. Submit a detailed Erosion and Sedimentation Control Plan prepared by a Professional Engineer licensed to practice in the State of Connecticut to the Owner, and Engineer. Measures shown on the drawings are the minimum required. The Plan shall include specific measures related to the Contractor's means and methods for carrying out the proposed work. The Plan shall note the sequence of construction and any phasing of the work.

C. Submit a dewatering plan that will ensure protection of wetland areas and particularly the storm drainage system. Prior to the start of any work, this plan must be approved by the Engineer and the Owner.

D. Erosion Control Blanket or mat and Filter Fabric: 12" x 12" sample with manufacturing data and instruction for installation.

E. Shredded Bark Mulch: 1 gallon showing range of size, tree material, and name and address of supplier.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Hay Bales.

1. Hay bales shall consist of hay from acceptable grasses and legumes, free from weeds, reeds, twigs, chaff, debris, other objectionable material, or excessive amounts of seeds and grain. Hay shall be free from rot or mold and the moisture content shall not exceed fifteen (15) percent by weight at the time of weighing.
2. The hay shall be securely baled with wire of adequate size to allow for possible rusting while in use and to permit rehandling when the bale is in a saturated condition.
3. Individual bales shall be of a longitudinal shape not exceeding one hundred (100) pounds when weighed.

B. Stakes for Silt Fence: Hardwood or metal. Posts shall be of wood or steel and a minimum of 3.5 feet long. Wood posts shall be nominal 1 x 1 inches. Steel posts shall be round or U, T or C-shaped with a minimum weight of 1.3 pounds per foot, and have projections for fastening the wire to the fence.

C. Silt Fence Fabric:

1. Filter fabric for silt fence shall consist of pervious sheets of woven propylene, nylon, polyester, or ethylene yarn. Filter fabric material shall be on the ConnDOT approved material list and shall meet the following requirements.

Minimum Requirements for Geotextile Silt Fencing

Physical Property	Test Method	Requirements
Filtering Efficiency	ASTM 5141	75% (min)
Grab Tensile Strength (lbs)	ASTM D4632	100 lbs
Elongation at Failure	ASTM D4632	15%
Mullen Burst Strength	ASTM D3786	250 psi
Puncture Strength	ASTM 4833	50 lbs
Apparent Opening Size	ASTM D4751	0.90 mm to 0.60 mm
Flow Rate	ASTM D4491	0.2 gal/ft2/min
Permittivity	ASTM D4491	0.05 sec. -1(min)
Ultraviolet Radiation Stability %	ASTM D4355	70% after 500 hours of exposure
Coefficient of Permeability k	ASTM D4491	0.01 cm/sec.
Grab Elongation	ASTM D4632	30% maximum
Trapezoid Tear Strength	ASTM D4632	65 lbs.

The filter fabric shall contain a stabilizer and/or inhibitors to make the filaments resistant to deterioration resulting from exposure to sunlight or heat to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120 degrees F. The filter fabric shall be a minimum of 36 inches wide, cut from a continuous roll to finish fence length to avoid the use of seams. Splice filter fabric together only when absolutely necessary and only at a support post, with a minimum 6-inch overlap and securely sealed. The filter fabric shall be free of defects or flaws which significantly affect its physical and/or filtering properties.

D. Wire Backing:

1. Wire for backing reinforcement shall be a minimum of 14.5 gauge with maximum mesh spacing of 6 inches.
2. Minimum height shall be 42 inches.

3. Wire staples for attaching filter fabric to wooden posts shall be No. 9 gauge and shall be at least 1 inch long.

E. Filter Fabric shall conform to requirements of M.08.01-26 of Form 817.

F. Erosion Control Mat shall conform to Section M.13.09 of the Form 817. Erosion control matting shall be on the CT DOT Qualified Product List for erosion control materials.

TYPE 1. Slopes 4h:1v to 3.1h:1v or as noted on the drawings:
minimum fabric weight of 7.5 oz./sy
100% straw fiber matrix
Biodegradable natural organic or photodegradable fiber netting (one side)

TYPE 2. Slopes 3h:1v to 2.1h:1v or as noted on the drawings:
minimum fabric weight of 8.5 oz./sy
100% straw fiber matrix
Biodegradable natural organic or photodegradable fiber netting (top and bottom)

TYPE 3. Slopes 2h:1v to 1.6h:1v or as noted on the drawings:
minimum fabric weight of 10 oz./sy
70% straw fiber; 30% coconut fiber matrix
Biodegradable natural organic or photodegradable fiber netting (jute fiber top and bottom)

TYPE 4. Drainage swales or as noted on the drawings:
minimum fabric weight of 8.5 oz./sy
100% straw fiber matrix
Biodegradable natural organic or photodegradable fiber netting (top and bottom)

Minimum Performance Standards:
Class 1: Slope Protection – Based upon the steepness of the slope and the soil type.

TYPE A. Slopes 3:1 or Flatter – Clay Soils
TYPE B. Slopes 3:1 or Flatter – Sandy Soils
TYPE C. Slopes Steeper than 3:1 – Clay Soils
TYPE D. Slopes Steeper than 3:1 – Sandy Soils

Minimum Acceptable Vegetation Density Standards:

Slopes	Clay Soils	Sandy Soils
3:1 or Flatter	80%	70%
Steeper than 3:1	80%	70%

Minimum Acceptable Sediment Loss Standards (kg/10 m^2):

Slopes	Clay Soils	Sandy Soils
3:1 or Flatter	0.35	12
Steeper than 3:1	0.35	27

Class 2: Flexible Channel Liner Protection – Based upon permissible shear stress present (T_p).

TYPE E. Permissible Shear stress = <25 Pa
Type F. Permissible shear stress = 25 to <50 Pa
Type G. Permissible shear stress = 50 to <100 Pa
Type H. Permissible shear stress = ≥100 Pa

Minimum Acceptable Vegetation Density Standards: 70%

Minimum Acceptable Sediment Loss Standards:

Shear Stress	Average Soild Deformation (cm)
1– 100 Pa	1.15
>100 Pa	1.00

G. Shredded Bark Mulch:

1. Air-dried, pine or hardwood bark shredded to a size ranging from 1/4 inch to 2 inches.
2. Free from rot, leaves, twigs, shavings, coarse material, debris, and any other materials injurious to plant growth.

H. Hay Mulch:

1. Obtain from acceptable grass or legume mowings, free from weeds, course matter or other objectionable material.
2. Free from rot or mould with moisture content of not more than 15 percent when delivered to project.

I. Mulch Binders:

1. Asphalt: Approved product manufactured for this purpose.
2. Synthetic: Approved product manufactured for this purpose.

J. Crushed stone for construction entrance: 2 inch diameter conforming to M.02.01-2 of Form 817.

K. Temporary Seeding: Temporary seeding shall be placed if the contractor anticipates leaving exposed areas over the winter months.

L. Silt sack shall consist of filter fabric (see below), lifting straps, and containment area.

1. Filter fabric for silt sack shall consist of pervious sheets of woven monofilament fabric. Filter fabric material shall meet the following requirements.

PHYSICAL REQUIREMENTS FOR SILT SACK FABRIC

Property	Test Method	Requirement
Grab Strength	ASTM D-4632-86	200 lbs.
Grab Elongation	ASTM D-4632-86	24x10
Trapezoid Tear Strength	ASTM D-4632-86	75 lbs.
Mullen Burst Strength	ASTM D-3786-80a	450 psi
Coefficient of Permeability k	ASTM D-4491-85	0.14 cm/sec.
Ultraviolet Stability	ASTM D-4355-84	70%

PART 3 - EXECUTION

3.1 GENERAL:

A. The Contractor shall plan and execute all operations, particularly those associated with excavation and backfilling, in such a manner as to minimize the amount of excavated and exposed fill or other foreign material that is washed or otherwise carried into wetlands and waterways.

B. The Contractor shall furnish and place hay bales, silt fencing, and other materials necessary for sedimentation and erosion control for streams and wetlands.

C. In the event the sedimentation or siltation prevention measures used by the Contractor prove to be inadequate as determined by the Engineer, the Contractor shall be required to adjust his operations to the extent necessary to prevent any such sedimentation or siltation from occurring.

D. The Contractor shall keep streams, brooks, and other water crossings clear of mud, silt, debris and other objectionable materials resulting from his construction operations.

1. The Contractor shall maintain flow capacity of river and stream channels to prevent unnatural flooding due to the Contractor's operations.

E. The Contractor shall use temporary vegetation, soil stabilization matting, and mulching to protect areas exposed during construction. He shall minimize the amount of bare

earth exposed at any one time during construction, and he shall also minimize the length of time bare earth is exposed. Excavated material to be stockpiled for reuse shall be stored away from brooks, streams, and wetland areas to prevent the washing of same back into the resource area.

F. Baled hay shall be placed to form temporary water stops, dams, diversions, dikes, berms and for other uses connected with water pollution control. Should any bales become too clogged to be effective, they shall be removed from the site and new hay bales provided as directed by the Engineer. Bales shall be replaced as often as necessary to provide effective sediment control. Following completion of construction activities in a particular area, bales shall be legally disposed of, by the Contractor, off-site in an environmentally sound manner.

G. On sloping terrain, hay bales may be used to trap sediment until vegetation has become established. The details of their placement shall be as approved by the Engineer.

H. Sediment laden water that is being pumped from the trenches or excavations shall not be pumped directly into water courses. Sedimentation basins of filter fabric, wire fencing and hay bales or other means acceptable to the Engineer shall be used for this purpose.

1. If, in the sole opinion of the Engineer, the sedimentation system is not sufficient, the contractor shall be required to provide gross particle separator(s) upstream of the pump discharge areas. These separators may consist of dual compartment septic tanks, with inlet and outlet baffles. The outlet from the tank shall discharge into the sedimentation basins described above.

I. Spoil resulting from the trench excavation shall be leveled or removed to permit entry of water from adjacent land surfaces without excessive erosion or harmful ponding.

J. The silt fence shall be maintained at no additional cost to the Owner as follows: Inspect silt fences and filter barriers immediately before and after each rainfall and at least daily during prolonged rainfall. Provide any required repairs immediately. Should the fabric on a fabric silt fence decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, replace the fabric promptly.
Remove sediment deposits after each storm event as directed by the Engineer. As a minimum, remove sediment when deposits reach approximately one-half the height of

the barrier. Dispose of sediment deposits off-site, placed upland in a manner which will prevent its later erosion into the resource area, or in a manner approved by the Engineer.
Maintain the fabric silt fence until all upslope soils are permanently stabilized by vegetation.

3.2 HAY BALE CHECKS AND BARRIERS:

A. Hay bales shall be held together by twine or wire and shall be made of hay or straw weighing from a range of 40 to 120 pounds. Hay bale stakes shall be a minimum of 36 inches long and must be either steel posts with a minimum weight of 0.5 pound per linear foot, or hardwood that are at least 1.5 inches square.

B. Place hay bale checks and barriers where indicated on Drawings.

C. Excavate soil to form shallow trench, place, and firmly stake bales with at least 2 stakes driven a minimum of 18 inches into the ground. The first stake should be driven into the previously laid bale in order to hold the bales together. Wedge loose hay between bales. Backfill the bales up to at least 4 inches and compact excavated soil against hay bales.

D. Conform to installation details indicated on Drawings.

E. Maintenance

1. Inspect checks and barriers at least once a week and within a day after each storm.
2. Remove accumulated sediment periodically and when deposits reach approximately one half of the height of the bale.
3. Repair any damage immediately, or install another bale upslope once observing failure of the barrier.

F. Removal and clean-up

1. Remove checks and barriers when no longer required or when directed by Engineer.
2. Restore disturbed areas to finish surface indicated on Drawings.

3.3 SILT FENCE:

A. A trench with minimum dimensions of 6 inches deep by 6 inches wide must be excavated on the up slope side of the fence location. For slope and swale installations, the ends of the trench shall be sufficiently extended up slope in order to allow the bottom end of the fence to be higher than the top of the lowest portion of the fence.

B. Place silt fence where indicated on the Drawings.

C. On the down slope side of the trench, support posts shall be driven at least 1 foot into the original ground. Post shall never be more than 10 feet apart. Posts shall be installed closer than 10 feet apart when concentrated flows are anticipated in certain regions.

D. Staple the filter fabric to the support posts leaving at least 6 inches of geotextile lying within the trench. The height of the fence shall not exceed 30 inches. If manufacturer's instructions are not present, space the wire staples on the wooden stakes at a maximum distance of 4 inches apart and alternate the axis from parallel to axis of the stake, to perpendicular. Do not staple to living trees of any kind.

E. Maintenance

1. Inspect checks and barriers once a week and within a day after each storm. Check periodically if used for dewatering while pumping is taking place.
2. Remove accumulated sediment periodically and when deposits reach one half of the height of the fence.
3. Repair any damage immediately or install a secondary silt fence up slope if there is room.

F. Removal and clean-up

1. Remove checks and barriers when no longer required or when directed by Engineer.
2. Restore disturbed areas to finish surface indicated on Drawings.

3.4 HAY MULCH:

A. Spread mulch immediately following seeding operations.

B. Mulch shall be uniformly spread by hand or machine at a rate of approximately 2 tons per acre.

C. Apply mulch to obtain a uniform depth without matted spots.

D. Stabilize mulch immediately after mulch is spread with netting, asphalt, or synthetic tacking material.

E. Conform to manufacturer's instructions and obtain firm, continuous contact between mulch and soil.

F. Maintenance

1. Repair and replace areas which have been damaged.

G. Removal and Clean-up

1. Remove checks and barriers when no longer required or when directed by Engineer.
2. Restore disturbed areas to finish surface indicated on Drawings.

3.5 SHREDDED BARK MULCH:

A. Spread mulch immediately following finish grading and planting.

B. Apply mulch to obtain a uniform depth of 3 inches. Remove large pieces and debris.

C. Repair and replace mulch as required to protect underlying soil.

3.6 SWALES:

A. Construct stone swales around perimeter of excavation. Swale shall maintain a positive pitch to temporary sediment basin. Swales and sediment basin shall be cleaned as required to maintain function.

3.7 CONSTRUCTION ENTRANCE:

A. Install temporary construction entrance using angular stone sized according to the standards placed by ASTM C-33, size No. 2 or 3, or Connecticut Department of Transportation Form 817 Section M.01.01, size #3, 2 inch crushed stone.

B. Fibers used in the geotextile shall be made up of synthetic polymers composed of at least 85% by weight polyesters, polyamides, polypropylenes, polyethylene, polyolefins or polyvinylidene-chlorides. Geotextile shall be intended for road stabilization and match accordingly with the manufacturers recommendations for intended use.

C. Construction entrance shall be located in a destination with maximum utilization of construction vehicles, which should stay away from areas of poorly drained soils if possible. Clear area of all vegetation and install subsurface drainage in poorly drained areas.

D. Dimensions

1. Width shall be a 12-foot minimum with points of ingress or egress flared sufficiently
2. Length shall be a 50-foot minimum; 100-foot minimum if the tracked sediments contain less than 80% sand. If the traveled length is less than the minimum length, than the entrance shall be the traveled length.

E. Maintenance

1. Keep the entrance in a condition in which tracking and washing of sediment doesn't approach paved surfaces. If necessary, provide periodic topping or additional length of stone in areas where it is needed.

F. Remove stone when no longer required. Restore subgrade and finish to grades with materials indicated on the Drawings.

3.8 FILTER FABRIC AND SILT SACKS AT CATCH BASINS:

A. Place filter fabric and/or silt sack under grate at each catch basin in areas to be paved immediately after catch basin installation at locations indicated on the Drawings.

B. Clean and replace filter fabric and silt sacks as required to protect catch basins and pipes.

3.9 PROTECTION OF AIR RESOURCES:

A. During the progress of work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of water as necessary, so as

to minimize the creation and dispersion of dust. If the Engineer decides that it is necessary to use calcium chloride for more effective dust control then the Contractor shall furnish and apply the material as directed.

B. Calcium chloride shall be commercial grade, furnished in 100-pound, 5-ply bags, stored under weatherproof cover and stacked alternately for ventilation. Application for dust control shall be at the rate of about 1/2 pound per square yard per application, unless otherwise directed by the Engineer.

C. Burning of rubbish and waste material on the site shall not be permitted.

D. Construction equipment shall be equipped with properly operating emission control devices and mufflers. Equipment not utilizing said devices shall be removed immediately from the site.

3.10 HAZARDOUS MATERIAL AND WASTE CONTROL:

A. Disposal of volatile fluid wastes (such as mineral spirits, waste oil, gasoline, or paint thinner) in storm or sanitary sewer systems or into streams or waterways shall not be permitted.
In the event that any such waste is spilled onto the ground, the Contractor shall immediately notify the Engineer, promptly clean up the spillage and all contaminated soil, and dispose of the cleanings as hazardous waste material. If a spill occurs, the clean-up activities shall take precedence over normal construction activities in order that damage to the environment is minimized.

B. Fuels, lubricants or other hazardous materials shall not be stored in any resource areas.

C. Fuel, lubricants and other hazardous materials shall be stockpiled within an area of positive containment. The area shall have no open communication with surface water bodies or other resource areas, shall have a base of relatively impermeable material and shall have an adequate supply of materials required for spill clean up.

D. All hazardous materials containers shall be properly marked and their contents identified. All fuel oil, lubricant, gasoline, and hydraulic fluid containers shall be fixed in place on the transport vehicle when the vehicle is in motion.

E. The construction project shall be in compliance with all Federal, State, and local laws with respect to hazardous materials.

F. All clean up and disposal operations shall comply with all applicable Federal, State, and local statutes, regulations and ordinances and anti-pollution laws.

G. Excavation and disposal of contaminated, polluted, or “environmentally compromised” materials shall be conducted in conformance with the environmental and abatement specifications. The handling of contaminated, polluted, or “environmentally compromised” water to be discharged as a result of dewatering shall be performed in accordance with the environmental and abatement specifications.

3.11 NOISE ABATEMENT:

A. Construction equipment including generator and compressors shall be enclosed or equipped with mufflers, silencers or other equipment to minimize noise.

B. The Contractor shall limit construction noise in accordance with EPA latest standard criteria.

3.12 PERMITS:

A. The Contractor shall comply with all requirements of all applicable Federal, State, and local regulations and all permits issued for the Contract.

B. General Permit Registration or the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, for disturbed areas greater than 1 acre.

1. Assume responsibility for storm water pollution control by submitting to the Connecticut Department of Energy and Environmental Protection (DEEP) a "General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities" registration; conform to the permit requirements.
2. Conform to the Erosion and Sediment Control Plan included in the Contract Documents or use another plan, prepared at the Contractor's expense by a Professional Engineer, licensed by the State of Connecticut, which has been approved by the Owner and the Connecticut Department of Energy and Environmental Protection.
3. Sign and cause to be signed by each appropriate subcontractor, the Certification Statement required by the General Permit.
4. Provide, maintain, and monitor a rain gauge on the site; monitoring shall include maintaining a log of the readings. The rain gauge shall remain the property of the Contractor.

5. Inspect all erosion controls measures on a weekly basis and after each rainfall event. Record corrective measures and repairs that are required, when they were performed and who made the corrections/repairs.

End of Section 31 25 00

SECTION 31 41 00 – EXCAVATION SUPPORT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to work of this Section.

B. All related Specification Sections shall be used in conjunction with this Section.

1.2 SUMMARY:

A. Installation, maintenance, and removal of excavation support systems including the following:

1. Structure excavation.
2. Shoring excavation.
3. Trench excavation.

1.3 SUBMITTALS:

A. Provide services of registered Structural Engineer to design bracing, shoring, and/or underpinning if this work is required. Submit Engineer's design for record purposes.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Materials shall include support members such as soldier piles, lagging, sheet piles, and other bracing members such as walers, struts, shores, and tieback anchors.

PART 3 - EXECUTION

3.1 EXCAVATION SUPPORT:

A. The Contractor shall be totally responsible for the means and methods of excavation and for the design and construction of the excavation support system.

B. All excavation support systems shall be constructed so as to be able to support all vertical and lateral loads and other surcharge loads imposed on the system during

construction including earth pressures, utility loads and other surcharge loads in order to provide safe and expeditious construction of the permanent structures and prevent movement and/or damage to adjacent soil, buildings, structures and utilities.

C. The support system shall be designed to support the maximum loads that will occur during construction.

D. The Contractor shall not perform excavations in running ground and must employ a positive means of containing material behind support walls before excavation is allowed to proceed.

E. The Contractor shall monitor all excavations to accurately provide a means of determining movement of adjacent soil, buildings, structures, and utilities.

F. When movement or damage is observed, the Contractor shall immediately cease excavation operations and correct such deficiencies in the excavation support system that have allowed for movement or damage and repair any and all damage that has resulted.

G. The Contractor shall be responsible for and repair any and all damage resulting from his excavations at no additional cost to the Owner and at no additional time for performance.

3.2 ADJACENT STRUCTURES:

A. Protect Adjacent Structures: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of adjacent structures.

1. Strengthen or add new supports as required during progress of the work.

End of Section 31 41 00

SECTION 32 12 16 – BITUMINOUS ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Bituminous paving for parking lots and roadways and associated preparatory work.

B. Aggregate base course.

C. Gravel subbase.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to work of this Section.

B. All related specification sections shall be used in conjunction with this section.

1. Section 31 23 33; “Trenching and Backfill”.
2. Section 31 00 00; “Earthwork.”

1.3 REFERENCE STANDARDS:

A. The State of Connecticut Department of Transportation Standard Specifications for Road and Bridge Construction (Form 817).

1.4 SUBMITTALS:

A. Submit under provisions of Division 1.

B. Letter of compliance shall be furnished by the Contractor to the Engineer prior to the placing of material listed under this Item.

C. Mix/batch design shall be submitted for each type of bituminous asphalt concrete to be placed.

D. Material certificate for tack coat.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Subbase

1. Subbase material shall conform to the requirements of Article M.02.02, CONNDOT FORM 817 for Bank Gravel or unless indicated otherwise on the drawings.

B. Processed Aggregate Base

1. Base material shall conform to the requirements of Article M.05.01, CONNDOT FORM 817.

C. Geotextile (Filter Fabric) shall conform to Section 7.55 of the 817 and shall meet the following minimum requirements:

minimum fabric weight of 16 oz./sy
minimum grab tensile strength of 350 lbs
minimum puncture resistance of 195 lbs

D. Bituminous Materials

1. Bituminous concrete, tack coat, joint sealer, etc. for road repairs shall conform to the requirements of Section M.04, CONNDOT FORM 817.

a. Surface course of pavement mixture shall be Superpave HMA S0.5, as defined in CONNDOT M.04.03.
b. Binder course of pavement shall be Superpave HMA S1, as defined in ConnDOT M. 04.03.

F. Temporary Steel Plates

1. Temporary steel plates for temporary trench covers shall be suitable to withstand traffic loading, including AASHTO H20 loads. Plates shall also conform to additional requirements as indicated on the traffic control plans. Steel plates shall not be left in place for more than 12 hours. All trenches must be backfilled prior to holidays, weekends, and other extended suspensions of the work.

G. Material for Tack Coat

1. Tack coat shall be emulsified asphalt conforming to Section M.05 of Form 817.

PART 3 - EXECUTION

3.1 GENERAL:

A. Areas to receive bituminous paving shall be as shown on the Drawings or as specified herein.
B. Pavement restoration shall be as shown on the Drawings or as specified herein.

3.2 EXECUTION:

A. In areas where trenching was conducted, the Contractor shall allow a 30-day settling period to transpire before placing permanent pavement, or as determined by the Engineer.

B. Edges of pavement removed during trenching or other excavations shall be sawcut to provide one-foot minimum overlap of the final patch on undisturbed material.

C. Base course shall be constructed in the areas and to the depths shown on the Drawings and in accordance with CONNDOT Specifications, except as herein modified.

1. Gravel base and processed gravel base courses shall be placed in maximum 6-inch lifts compacted to 95% maximum density, unless otherwise directed by the Engineer.
2. Gravel shall be fine graded with a power grader or other approved equipment. Tolerance shall be within 1/2" or less.
3. No pavement shall be placed until fine grading has been checked and reviewed by the Engineer.

D. Bituminous wearing and base courses shall be constructed as per CONNDOT Specifications, except as herein modified.

1. Pavement shall only be placed when the underlying surface is dry, frost-free and the surface temperature is above 50°F, unless otherwise directed by the Engineer.
2. Pavement shall only be placed during daylight hours.
3. Material delivered to the paver shall not have a temperature lower than 250°F.
4. All catch basins shall be covered with an acceptable cover before the paver passes over the grate.
5. Manholes and other castings shall be sprayed with kerosene or other product before the paver passes over the casting. The casting shall be clean of asphalt at the completion of the paving.
6. Extreme care shall be used around catch basins. The Contractor shall do the necessary handwork to provide a downward slope into the grate.

7. Compaction shall be performed by an 8-ton minimum static steel wheel roller followed by a pneumatic-tired roller.
8. The wearing course shall be rolled until all roller marks are eliminated.

End of Section 32 12 16

SECTION 32 13 13 – CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.2 SUMMARY:

A. Provide all labor, materials and equipment required to perform the work called for in this section of the Specification, or as shown on the drawings, including but not necessarily limited to the following:

1. Installing concrete sidewalk.

B. Related Work: The following sections contain requirements that may apply to this section:

1. Section 31 23 00 - "Excavation and Fill."
2. Section 03 30 00 - "Cast-in-Place Concrete."
3. Section 03 21 00 - "Concrete Reinforcing."

1.3 SUBMITTALS:

A. Submit under provisions of Division 1.

B. Submit supplies, product test reports, and required material certification for concrete, and reinforcing steel.

C. Submit supplies, product test reports, and required material certification for concrete curb.

1.4 QUALITY ASSURANCE:

A. All work of this section shall be provided in accordance with the latest edition of State of Connecticut Department of Transportation Form 817 which is considered to be part of this specification, the same as if fully set forth herein.

B. All sidewalks and ramps shall be constructed to conform to ADA requirements.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Concrete: Article M.03.01, DOT Specifications. Concrete shall be 5,000 psi.

B. Air-Entraining Portland Cement and Entraining Admixture: Article M.03.01, DOT Specifications.

C. Welded Steel Wire Fabric: Sub article M.06.01-3, DOT Specifications. Steel mesh shall be in accordance with the Concrete Reinforcing Steel Institute (CRSI).

1. Minimum reinforcing: epoxy coated 6 x 6 – W1.4 x W1.4.

D. Reinforcement: Sub article M.06.01-1, DOT Specifications.

E. Processed Base: As specified under Section 31 23 00 - “Excavation and Fill.”

F. Expansion Joint Filler: Bituminous cellular type, AASHTO M213.

G. Protective coating shall be composed of Harris Emulsion Kurseal 309.

H. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and retain horizontal and vertical alignment until removal. Use forms free of distortion and defects.

1. Use flexible spring steel forms or laminated boards to form radius bends as required.
2. Coat forms with a non-staining, clear, form release agent, which will not discolor or deface the surface of the concrete.

I. Dowels and sleeves shall be galvanized steel, ¾ inch dia. and a minimum length of 10 inches and conform to M.06.01 and M.06.03, DOT Specifications.

PART 3 - EXECUTION

3.1 GENERAL:

A. Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted

to a firm, even surface conforming to the section shown on the plans. All soft and yielding material shall be removed and replaced with acceptable material.

B. Place and compact the base in layers not to exceed 6" in depth and to dimension after compaction as shown on the drawings. Wet and roll or tamp the base after the spreading of each layer to a maximum toleration shall be 1/4" and compacted to 95% maximum density.

C. Construct forms of metal or wood. Construct forms straight, free from warp and of sufficient strength to resist springing from the pressure of concrete. Make forms tight to prevent leaking of mortar. Clean and wet forms before placing concrete against them.

D. Proportion, mix, and place concrete in accordance with Section 03 30 00.

E. Place concrete curb to the lines and grades where shown on the plans in accordance with section 8.11.03 of DOT form 817.

F. Finishing:

1. Concrete shall have a smooth trowel finish by skilled concrete finishers, a broom finish shall then be applied to obtain a non-skid texture.
2. All outside edges and joints shall be edged with an edging tool having a radius of 1/4 inch or as indicated on the Plans.

G. Concrete shall be cured for a minimum of 7 days. Curing compounds will not be permitted. Plastic sheets or other approved materials shall be placed in close contact with the finished concrete as soon as the concrete has set sufficiently to avoid damage from the placement of coverings. The protective covering shall be maintained vapor-proof in close contact with the concrete for the entire 7-day period. All traffic shall be excluded during the curing period. Vehicular traffic shall be excluded for such additional time as ordered.

H. Acceptance: The Engineer shall review each panel after the concrete has had sufficient time to set. If in the opinion of the Engineer sufficient imperfection exists, the panel will be rejected and the Contractor shall remove and repour the defective panel. The Contractor is responsible for any damage, either by construction-related activities or vandals until final acceptance.

I. Protective Coating:

1. Apply Harris Emulsion Kurseal 309 to seal concrete. Apply Harris Emulsion Kurseal 309 to still damp freshly finished concrete as soon as the surface cannot be marred and water sheen disappears. Do not apply over freestanding water. If application is delayed concrete must be kept wet (preferably by water) until product can be applied. Apply first coat at 200 sq ft/gal. A second coat is recommended for long term durability. See manufacturers' requirements for second coat application.

J. Backfill sides of work with suitable material thoroughly compacted and finished flush with the tops of the sidewalks. Remove and dispose of all surplus material.

K. The Contractor will be responsible for all concrete pads until accepted by the Owners Representative.

End of Section 32 13 13

SECTION 32 17 13 - BOLLARDS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnishing and installing bollards.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary General Conditions and other Division 1 Specification sections, apply to work of this Section.

B. All related Specification Sections shall be used in conjunction with this Section.

1.3 SUBMITTALS

A. Submit under provisions of Division 1.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Pipe shall be 8-inch diameter Schedule 40 seamless galvanized steel pipe or equivalent.

B. Protective cover shall be 1/8” thick High Density Polyethylene with reflective tape; color: yellow

C. Hot dip galvanized coating shall be in accordance with ASTM A 123/A 123M - Hot Dip Galvanized Coatings.

D. Concrete shall be as specified in Division 03.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall install bollards as shown on the Drawings.

B. Installation and anchorage of bollards shall be as detailed on the Drawings.

C. All bollards shall be set plumb.

End of Section 32 17 13

SECTION 32 31 13 - CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to this section.

B. All related specification sections shall be used in conjunction with this section.

1.2 SUMMARY

A. Provide all labor, materials, tools and equipment, as and when required to perform the work specified herein or as shown on the plans, including but not necessarily limited to the following:

1. Provide and install vinyl coated chain link fence fabric (height as specified on the drawings) framework and accessories where shown on the plans and as specified herein. Do not perform this work without the approval from the Owner's Representative.
2. Line Post Spacing: At intervals not exceeding 8 feet.

B. Related Work:

1. Section 31 10 00 - "Site Clearing."
2. Section 31 23 00 - "Excavation and Fill."

1.3 REFERENCES

A. ANSI/ASTM A123 - Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

B. ANSI/ASTM F567 - Installation of Chain-Link Fence.

C. ASTM A116 - Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.

D. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses.

E. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

F. ASTM A392 - Zinc-Coated Steel Chain-Link Fence Fabric.

G. ASTM A428 - Weight of Coating on Aluminum-Coated Iron or Steel Articles.

H. ASTM A491 - Aluminum-Coated Steel Chain Link Fence Fabric.

I. ASTM A569 - Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality.

J. ASTM C94 - Ready-mixed Concrete.

K. ASTM F573 - Residential Zinc-Coated Steel Chain Link Fence Fabric.

L. ASTM F668 - Poly (Vinyl Chloride) (PVC) Coated Steel Chain Link Fence Fabric.

M. Chain Link Fence Manufacturers Institute (CLFMI) - Product Manual.

N. FS RR-F-191 - Fencing, Wire and Post Metal (and Gates, Chain Link Fence Fabric, and Accessories).

O. Conn DOT Form 817

1.4 SUBMITTALS

A. Submit under provisions of Division 1.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

C. Product Data: Provide data on fabric, posts, accessories, fittings, and hardware.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Materials and Components: Conform to CLFMI Product Manual or Conn DOT Form 817, whichever is more stringent.

B. Fabric Size: CLFMI Standard Industrial.

C. Intermediate Posts: Type I round.

D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round.

E. All posts shall be galvanized steel Schedule 40.

F. The polyvinyl chloride coated chain link fence material shall conform to section M.10.05.1 of Form 817. The color of the coating shall be black.

G. Posts, rails, caps, and accessories shall be hot dipped galvanized as per Section M.10.05.2 of Form 817. Outside galvanized surface shall be coated with the same polyvinyl chloride coating as the chain link mesh material.

2.2 COMPONENTS (As follows or Conn DOT Form 817, whichever is more stringent)

A. Line Posts: 2.38 inch diameter.

B. Corner and Terminal Posts: 2.88 inch.

C. Gate Posts: (1) 12' Double Swing Gate 6.0 inches and (1) 6' Single Swing Gate 2.875" Outer Diameter

D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Gate Frame: 1.66 inch diameter or as manufacturer recommends.

F. Fabric: 2-inch diamond mesh interwoven wire, 9-gauge thick, top salvage twisted tight, bottom salvage knuckle end closed.

G. Tension Wire: 7-gauge thick steel, single strand.

H. Tension Band: 1/8" x 1" prestressed steel.

I. Tension Strap: 1/4 x 3/4 inch thick steel.

J. Tie Wire: Aluminum alloy steel wire.

2.3 ACCESSORIES

A. Caps: Cast steel galvanized sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, and tension bars, fasteners and fittings; galvanized.

C. Extension Arms: Cast steel galvanized to accommodate single-arm, and vertical.

D. Gate Hardware: Fork latch with gravity drop; two 180° gate hinges per leaf and hardware for padlock.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install framework, fabric, accessories, and gates in accordance with manufacturer's instructions.

B. Set intermediate terminal and gate posts plumb, in concrete footings with top of footing 2 inches below finish grade. Slope top of concrete for water runoff.

C. Line Post Footing Depth Below Finish Grade: 4 feet.

D. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: 4 feet or as per manufacturer's recommendations.

E. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail, one bay from end and gate posts.

F. Provide top rail through line post tops and splice with 6-inch long rail sleeves.

G. Install center and bottom brace rail on corner gate leaves.

H. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

I. Position bottom of fabric 2 inches above finished grade.

J. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on center.

K. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

L. Install bottom tension strap stretched taut between terminal posts.

M. Install gate with fabric. Install three hinges per leaf, latch, catches, drop bolt, retainer, and locking clamp.

N. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

3.2 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Position: 1 inch.

C. Components shall not infringe adjacent property lines.

End of Section 32 31 13

SECTION 32 91 19 – TOPSOIL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions: of the Contract including General and Supplementary Conditions, and Division One General Requirements apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Work Included: Providing, testing, placing and finish, grading all stockpiled and borrow topsoil as shown on Drawings and specified herein to properly complete all lawn and planting operations.

1. Spread all stockpiled topsoil to produce a uniform depth throughout proposed general lawn areas.
2. Supply and spread borrow topsoil to a uniform depth throughout all proposed lawn areas.

1.3 RELATED WORK DESCRIBED ELSEWHERE:

A. Site Clearing: Section 31 10 00

B. Lawns and Grass: Section 32 92 00

1.4 QUALITY ASSURANCE:

A. Topsoil:

1. Testing: Representative topsoil samples shall be tested to determine:

a. Amendments necessary for good plant growth.
b. Acidity.
c. Organic content.
d. Mechanical analysis – sand, silt, and clay. Analysis shall include 200 sieve hydrometer wash as per ASTM D 422 to isolate specific percentages of silt and clay.

2. Both borrow and stockpiled topsoil shall be tested as per 1.04 A.1. Provide up to 3 tests for each stockpile used.

a. Topsoil testing costs shall be borne by the Contractor.
b. Testing laboratory shall approved by the Owner and Engineer.

1.5 SUBMITTALS:

A. Topsoil test results shall be submitted to the Engineer for review to determine acceptability. The Engineer will be the sole judge of acceptance.

1.6 PRODUCT HANDLING:

A. Delivery of borrow topsoil to the site shall be coordinated such that it is placed as delivered and no stockpiling required.

PART 2 - PRODUCTS

2.1 BORROW TOPSOIL:

A. Not to contain materials harmful to plant life, to be clean, fertile, friable, well draining, natural sandy loam. All topsoil to be free of any subsoil earth clods sods, stones over 1" in any dimension, sticks, roots, weeds, litter and other deleterious material. Topsoil shall be uniform in quality and texture and contain organic matter and mineral elements necessary for sustaining healthy plant growth.

B. Topsoil shall have the following optimum ranges unless otherwise approved by the Landscape Architect.

Organic content	3% - 15% (by loss of ignition at 375 C method of testing.)
pH	6.0 – 8.0

C. Nutrient levels shall be achieved by the Contractor's addition of amendments to the topsoil to meet the optimum nutrient levels specified in the testing laboratory report for each of crop/plant to be installed.

D. Proposed topsoil shall meet the USDA Soils Textural Classification percentages of sand, silt, and clay for "sandy loam" or "loam" classification.

E. Topsoil shall be completely free of any toxic chemical, hazardous waste and any material or condition that would prevent the establishment of a suitable lawn.

2.2 STOCKPILED TOPSOIL:

A. Stockpiled topsoil proposed for reuse shall conform to all requirements of paragraph 2.1 of this Section and shall be screened unless otherwise approved by the Engineer.

PART 3 – EXECUTION

3.1 SHAPING AND GRADING OF SUBSOIL AT ALL LAWN AREAS:

A. After rough grading has been completed, shape and grade lawn subgrade areas to lines and levels as noted on the drawings.

B. Shape subgrade areas to allow placement of uniform depths of stockpiled and borrow topsoil. Adjustments may be necessary due to field conditions. Provide all shaping adjustments at no additional cost to the owner.

3.2 TOPSOIL SPREADING:

A. After shaping of lawn subgrades remove all sticks, stones, or foreign material two (2) inches or greater in dimension. Harrow or otherwise loosen the subgrade soil to a depth of three (3) inches if required to correct overcompaction. Remove debris and stone off-site.

B. Do not apply topsoil to the scarified subgrade without approval by the Engineer. Topsoil will not be permitted to be spread until topsoil test reports have been submitted and approved. Topsoil shall not be delivered or worked in a frozen or muddy condition.

C. Uniformly distribute and spread stockpiled and borrow topsoil from over all graded lawn areas to conform smoothly to the lines, grades, and elevations shown or otherwise required. All lawn areas to have a minimum of six (6) inches of topsoil after compaction.

D. Topsoil shall be spread in (2) (stockpiled and borrow material) lifts. Each lifts shall be thoroughly mixed with the previous subgrade by disking, harrowing, or other approved means.

E. Compaction of topsoil shall consist of raking the topsoil to remove debris and provide uniform grade, rolling the topsoil in one direction, raking the topsoil to fill low areas and remove high areas and re-rolling 90 degrees to first rolling. Roller shall be 30 gal. maximum hand roller.

F. Loosen topsoil to a depth of 4" by scarifying or other disking methods. Obtain a loosened friable soil bed to a depth of 3-4". At no time will rubber tired loaders or graders having greater compaction than a small farm tractor be allowed on topsoil. Keep all heavy equipment and trucks off prepared topsoil. Do not prepare while ground is wet or frozen.

G. Provide additional topsoil where and as required to properly meet all proposed finish grades.

H. Remove any weeds, debris, foreign matter, and stones having any dimension greater than ¾". Remove from property.

I. Fine grade to a smooth uniform surface. The entire area shall present an even grade with no depressions where water will stand. Any protective fencing around existing trees shall be removed and disposed of by the Contractor at this time. Topsoil shall be smoothly blended to existing finish grades around trees erosion control devices and adjacent existing conditions, maintain existing surface drainage patterns. Round-off all top and toe of slopes. Reinstall erosion control devices and protective fencing as required.

J. Approval of surface shall be obtained before seeding or sodding operations begin. If requested, perform bulk density and compaction readings to monitor degree of soil compaction/seed bed friability.

K. Place topsoil only when it can be immediately followed by seeding or sodding operations.

3.3 PROTECTION:

A. Keep: heavy equipment, trucks, etc. off topsoiled areas. At no time will equipment other than light tractors be allowed on any top soiled areas.

B. If compaction (greater than 90%) occurs, scarify to a depth of 4" and regrade. ASTM D1557-78, method C shall be used to measure compaction.

End of Section 32 91 19

SECTION 32 92 00 – LAWNS AND GRASSES

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. The Work of this Section includes, but is not limited to, furnishing all labor, materials, and equipment required to provide all lawns and grass, in place, as shown on the Drawings, specified herein, and as necessary for a complete installation.

1.2 RELATED WORK DESCRIBED ELSEWHERE:

A. All sections of Division 1.

B. Site Clearing: 31 10 00.

C. Topsoil: 32 91 19

1.3 QUALITY ASSURANCE:

A. Industry Reference Standards:

1. American Society for Testing and Materials (ASTM) publications: ASTM C 602, (1975) "Agricultural Liming Materials."
2. Federal Specifications (FS): FSO-F-241 C (1). Fertilizers: Mixed Commercial.
3. State of Connecticut: Department of Agriculture:

a. Connecticut Commercial Fertilizer Law: Chapter 427A (P.A. 73-278) of Connecticut General Statutes, Revisions and Subsequent Amendments.
b. Connecticut Agriculture and Seed Law: Chapter 424 of Connecticut General Statutes Revised to 1979 as amended.

B. Installer's Qualifications: Engaged firm must be able to provide evidence to indicate five years documented experience in the installation of work specified herein.

C. Requirements of Regulatory Agencies:

1. Comply with the requirements of State Department of Environmental Protection.
2. Hazardous Materials: Section 22A- 54 of the Connecticut General Statutes.
3. State Department of Agriculture

a. Commercial Fertilizer Law.

b. Agricultural and Vegetable Seed Law.

D. Source Quality Control: Producer's tests for purity and germination of seed dated within nine months of sowing.

1.4 SUBMITTALS:

A. General: Refer to Division I for Submittal Requirements.

B. Manufacturer's Product Data: Specifications and Instruction: Submit material specifications and Material Safety Data Sheets (MSDS) and installation instructions where applicable as required in Division I, attesting that the following materials meet the requirements specified:

1. Fertilizer
2. Seed Mix
3. Lime
4. Herbicides
5. Pesticides

C. Test Reports:

1. Laboratory Test Reports: Submit copies of the reports of all tests listed below for the following materials. Test reports shall be submitted within 30 days after test. Tests indicating modifications of a material, such as topsoil, shall be submitted and accepted by the Owner's Representative prior to beginning the modification.

a. Topsoil:

1) Tests shall be done by a university or private soils testing laboratory.
2) Report shall include recommended additives to correct deficiencies. Test for:

a) Chemical Analysis
b) pH
c) Mechanical Analysis
d) Organic Content

3) Up to three tests for each stockpile used shall be required, as determined by the Owner's Representative.

D. Certificates:

1. The Owner's Representative shall be furnished with duplicate signed copies of a statement from the vendor certifying that each container of seed delivered is labeled in accordance with The Connecticut State Department of Agriculture Agricultural and Vegetable Seed Law and the United States Department of Agriculture Seed laws.

E. Usage Verification: The Owner's Representative shall be furnished with product labels and verification of the quantities of materials used in performance of the work specified herein. Materials would include:

1. Fertilizer
2. Seed
3. Lime
4. Pesticides
5. Herbicides

F. Submittals Schedule:

1. Before Installation:
   a. Manufacturer's Product Data and Material Safety Data Sheets (MSDS).
   b. Test Reports.
   c. Seed Certificates.
2. During Installation: Usage Verification.
3. After Installation: Usage Verification.

1.5 JOB CONDITIONS:

A. Coordination: Coordinate all work of this section with related work of other sections. Failure to coordinate properly will not reduce the obligation to meet the standards of acceptance of the various elements of work contained herein.

B. Sequencing and Scheduling:

1. No lawn shall be begun until acceptance of fine grading by the Owner's Representative.
2. No seeding shall be done in the areas where construction operations may damage the work.

3. All existing or new lawn areas damaged by construction operations or other causes shall be repaired to the Owner's Representative's satisfaction.

C. Existing Conditions: All work that the work of this section is contingent upon shall be examined and any deficiencies shall be reported to the Owner's Representative. Commencement of work will be construed to mean complete acceptance of the preparatory work. No adjustment will be made for discrepancies brought to the attention of the Owner's Representative after work has begun.

D. Extent of Work: All areas of the project site affected by construction operations and not covered by building, roads, parking lots, walks, planting beds or other permanent improvements are to be covered by lawn. Should the type of lawn to be placed in a given area be unclear on the drawings, the Owner's Representative shall provide the final determination.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS REQUIREMENTS:

A. Water: Shall be potable or source approved by the Owner's Representative.

B. Seed Mulch:

1. Mechanical Seeding: Provide clean seed-free salt hay or threshed straw of wheat, rye, oats, or barley.
2. Hydroseed: Provide a cellulose pulp fiber such as "Silva Fibre" as produced by Weyerhauser Company, Tacoma, Washington, or substitution accepted by the Owner's Representative.

C. Soil Conditioners: The following soil additives shall be used singly or in combination as required to meet the specified requirements for topsoil.

1. Ground Limestone: Provide dolomitic agricultural limestone as defined in of ASTM C-51-81. The material must comply with the following gradation:

Square Mesh Sieves	Percent Passing By Weight
Pass #10	100
Pass #20	90
Pass #100	40

The minimum total carbonate content shall be 85%.

2. Fertilizer: Percentage by weight of nitrogen and phosphoric acid and potash shall be determined by the soil analysis. Provide a commercial grade with a minimum of 50 percent of the nitrogen being derived from organic sources and meeting the requirements of the Connecticut Commercial Fertilizer Law.

D. Erosion Preventative:

1. Mild Slopes: (Slopes less than 3 feet horizontal to1 foot vertical). Provide clean, seed free, salt hay, or threshed straw of wheat, rye, oats, or barley bound by Terra Tack AR as manufactured by Grass Growers, 424 Cottage Place, Plainfield, NJ 07060, (201- 755-0923) or substitution accepted by the Owner's Representative.
2. Steep Slopes: (Slopes 3 feet horizontal to 1 foot vertical or steeper). Provide 5 ounce burlap, jute netting five feet wide, or any other open fabric capable of natural decomposition.

E. Chemical Preventatives and Controls:

1. Immediately prior to the application of preventatives and controls, the Contractor shall determine whether each of the items is permitted in the State of Connecticut. Substitutions must be accepted by the Owner's Representative.
2. The chemical preventatives and controls shall be commercial materials for agricultural use accepted by the Owner's Representative.
3. Crab Grass Control: Provide Tupersan as manufactured by Dupont; Baylam as manufactured by Elanco Products Co., a division of Ely Lilly Company. Crab grass control with lawn seeding shall be Tupersan; spring crab grass control after a fall seeding shall be pendimethlin or an appropriate substitute approved by the Owner, applied at a rate and in accordance with manufacturer's recommendations.
4. Clover Control: Provide MCPP as manufactured by Diamond Shamrock or W.A. Cleary Corp.
5. Board Leaf Weed Control: Provide a non-phenol compound, such as Confront, approved by the Owner.
6. Lawn Pest and Disease Control: Provide material recommended by the Agricultural Extension Services State Entomologist or State Experiment Station and approved by the Owner.
7. Eradicant Herbicide: Provide Round up (Glyphosate) as manufactured by Monsanto. Apply as per manufacturer's recommendations for new lawn installations.

F. Seed Requirements and Analysis:

1. Shall conform to the requirements of the Connecticut Agricultural and Vegetable Seeds Law where applicable and shall be Blue Tag Certified Seed where described herein.
2. All seed mixes shall be submitted the Owner's Representative for approval.
3. The containers shall be delivered to the site unopened and with all labels attached.
4. Composition shall conform to the requirements in the following tables. Any change must be accepted by the Owner's Representative.
5. Seed shall be current year's seed and be 100% free of noxious weeds, Poa annua, and bent grasses. The mix shall vary depending on the timing of the planting as described herein.

    a. Lawn areas: All areas to receive "mowable grass seed mix" as indicated on the plans shall receive the following seed mix. All seed shall be Blue Tag Certified Seed.

TYPE SEED	LBS/ACRE	PURITY	GERMINATION
Creeping Red Fescue	5	98%	85%
Kentucky Bluegrass	45	85%	75%
Perennial Ryegrass (Pennfire)	10	95%	90%

    b. Slope Seed: For slopes 3:1 or greater

TYPE SEED	LBS/ACRE	PURITY	GERMINATION
Tall Fescue	15	95%	85%
Crown Vetch	15	95%	85%
Creeping Red Fescue	10	96%	85%

2.5 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Delivery:

1. Submit material delivery schedule in advance of the delivery so that material may be inspected upon arrival at the job site, Remove rejected material from the site immediately.
2. During delivery protect all materials from damage from the elements and neglect or abuse.
3. Deliver all materials to the site in their original, unopened containers bearing the manufacturer's analysis, name, trade name, or trade mark, and indication of conformance to State and Federal laws as required. Delivery will include material safety data sheets with products.

B. Storage: Provide dry storage for fertilizers, seed, herbicides and pesticides, and all other amendments in such a manner as to prevent damage or inclusion of foreign materials.

C. Handling: Avoid damaging materials being moved from the storage area to the planting site. Do not drop or dump materials from vehicles. Damaged materials will be rejected and shall be removed from the site immediately.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION REQUIREMENTS:

A. Pre-installation Inspection: Site shall be inspected as specified in Part 1; Job Conditions, prior to pre-installation job meeting.

B. Pre-installation Job Meeting: Prior to installation of work, conduct job meeting at project site with installers of other work requiring coordination, (if any) and Owner's Representative for purpose of reviewing job conditions, project requirements and procedures to be followed in performing work. All work of this section performed prior to the pre-installation job meeting shall be subject to immediate rejection.

3.2 RATES OF APPLICATION:

A. Chemical controls and preventatives and grass seed shall be applied at the following rates:

Material	Per 1,000 Sq. Feet
Initial Soil Amendments	Soil Test Recommendations
Grass Seed	Manufacturer's recommendations by mix type
Hay	80 lbs.
Hay Tackifier	2.75 pounds
Cellulose Pulp Fiber	30 pounds
Crabgrass Preventative	Manufacturer's Recommendations
Lawn Pest and Disease	Extension Services-State Entomologist's or State Experiment Station's Recommendations
Soil Insect Control	Extension Services State Entomologist's Recommendations
Board Leaf Weed Control	Manufacturer's Recommendations
Herbicide	Manufacturer's Recommendations for new lawn installations
Lawn Re-fertilizing	20-10-10 with 50% sulfur coated urea (SCU), 51 lbs. material per 1,000 s.f. to achieve 1 lb. N per 1,000 s.f.

3.3 INSTALLATION:

A. Planting Seasons: Installation of new lawns shall be done between April 15 and June 1st for Spring planting and August 15th and September 15th for Fall planting.

B. Soil Preparation:

1. Soil Preparation of New Lawn Areas Disturbed By Grading Operations:

a. Where lawns are to be planted in areas that have been altered or disturbed by excavating, grading, or stripping operations, prepare soil as follows:

1) Limit soil preparation to areas to be planted within 7 days.
2) Loosen topsoil within lawn areas to a minimum depth of 4 inches. Remove all stones over ¾" in any dimension, sticks, weeds, clods, lumps, roots, rubbish and other extraneous matter.

b. Protect existing lawn areas and create a smooth transition between them and new work with a tolerance not to seed ¼" over 10' unless expressly specified plans.

c. Fine grade as necessary to achieve a smooth even surface true to lime and grade with a tolerance not to seed ¼" over 10' unless expressly specified plans. Match grades smoothly with existing lawn areas to remain.
d. Secure acceptance of fine grading by the Owner's Representative prior to the commencement of seeding operations.

2. Soil Preparation of New Lawn Areas Undisturbed By Grading Operations:

a. Where lawns are to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil as follows:
b. Protect existing lawns to remain to prevent undue damage.
c. Create a smooth transition between new work and existing lawns to remain.
d. Apply Roundup (Glyphosate) to all existing areas which are to be seeded.
e. Allow 7 days prior to disturbing the soil.
f. Till soil to a depth of not less than 6 inches.
g. Grade lawn areas to a smooth uniform surface with a tolerance not to exceed ¼" over 10 feet, unless expressly specified on the plans. Fill in depressions and remove high areas.
h. Remove all stones over ¾" in any dimension, sticks, weeds, clods, lumps, roots, rubbish, and other extraneous matter.
i. Fine grade as necessary to achieve a smooth even surface true to lines and grades shown on drawing with a tolerance not to exceed ¼" over 10 feet, unless expressly specified on the plans.
j. Secure acceptance of fine grading by Owner's Representative prior to beginning seeding operations.
k. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry off before planting of lawns. Do not create a muddy soil condition.

3. Restore prepared areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

C. Seeding New Lawns:

1. Where fine lawns abut other newly planted or existing planted areas establish limits of fine lawn with lime. Secure approval by Owner's Representative of limed edge prior to beginning seeding operations.
2. Application of Soil Amendments:

a. Apply fertilizer, lime and other initial soil amendments evenly at rates determined by topsoil test results and thoroughly incorporate into the upper 2 inches of topsoil by disking, harrowing, or other acceptable methods.
b. Rake the finished surface smooth and free of stones greater than ½ inch.

3. Mechanical Seeding of New Lawns:

a. Do not use wet seed or seed which is moldy or has been damaged in transit or storage.
b. Sow seed using a spreader or seeding machine. Do not seed when wind velocity exceeds 5 miles per hour or when the ground is in a frozen, wet, or otherwise nontillable condition.
c. Sow no less than the quantity of seed specified.
d. Cover seed with a thin layer of topsoil by raking or dragging.
e. Immediately after the seeding operations have been completed, the seed shall be set with a cultipacker, brillion, or similar equipment with the final rolling at right angles to the prevailing winds to prevent wind erosion.
f. Protect seeded areas against erosion either by spreading specified hay mulch or hydro-mulching immediately after completion of seeding operations. If hay mulch is used, spread uniformly to form a continuous blanket not less than 80 lb. per 1,000 s.f. over seeded areas. Spread by hand, blower or other suitable equipment.
g. Anchor mulch by spraying with hay tackifier at the rate of 2.75 lb. Per 1,000 s.f. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean such areas where damage occurs.

4. Erosion Preventative: Slopes of one foot vertical to 3 feet horizontal or greater, or any areas which will receive concentrated run-off water, shall be covered with erosion control preventative. If a material preventative is used, overlap no less than one foot, and the material shall be secured by pegs. Do not remove material after germination. Let it decompose.
5. Maintain a moist seed bed at all times. Water the seed bed so that the topsoil is wet to a depth of two inches.
6. Protect the seed bed with barricades, if necessary, to keep all traffic off the areas.
7. Prior to the first mowing in the spring, consult with the Owner's Representative as to what areas will need to be re-seeded and those that will be filled in by fertilizing and rhizome and tiller development. Those areas that are determined to need reseeding will be done within four (4) days of such determination. All equipment used on the seed bed shall have turf tires. Areas that are determined

by the Owner's Representative to be isolated points of erosion that can not be stabilized by reseeding shall be sodded. Areas that require an application of herbicide shall be determined by the Owner's Representative. Contractor shall apply herbicide and reseed as required.

D. Hydroseeding New Lawns:

1. Mix specified seed, fertilizer, and pulverized mulch and pulverized mulch tackifier in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
2. Apply slurry uniformly to all areas to be seeded. Rate of application as required to obtain specified seed sowing rate.
3. Hydroseeding equipment may be either portable or truck mounted, with dual agitation, a minimum working volume of 1,000 gallons and a maximum spray range of 80 feet.
4. Hydroseeding equipment must be capable of uniformly applying the slurry mix, including wood fiber mulch, at the specified rate and at the required locations.
5. Seed, fertilizer, mulch, and water shall be mixed and applied to achieve application quantities specified. Material shall be applied in two (2) equal applications, with the equipment during the second pass moving perpendicular to the direction employed during the first pass. Hydroseeding shall not be done when it is raining or snowing, or when wind velocities exceed 5 mph. Seed shall not be placed in water until immediately before application.

E. Existing Lawns:

1. All existing lawn areas shall be protected from unnecessary damage due to construction operations.
2. Existing lawn areas within the Contract Limits shall be maintained by the Contractor until such time as construction or planting operations commence within them. At that time, the Contractor shall assume total responsibility for maintenance as specified herein of existing lawn areas within the contract limits until acceptance.

3.4 PROTECTION:

A. Erect barricades and warning signs as required to protect newly seeded areas and existing lawn areas from traffic. Maintain barricades until final acceptance.

3.5 MAINTENANCE:

A. General: Final acceptance of all work under Section 32 92 00 will be at the end of the maintenance period herein described.

B. Maintenance Period: Begin maintenance of new lawns immediately after each area is planted and continue until final acceptance. Begin maintenance of all existing lawn areas within the contract limits as required immediately after commencement of any disturbance and continue until final acceptance.

C. Specific Operations:

1. Maintenance shall consist of the following elements:

   a. Watering, fertilizing, weed control, disease control, insect control, mowing, trimming and other operations such as rolling, regrading or replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.
   b. Remulch with new mulch in areas where the mulch has been displaced by wind or maintenance operations. Anchor as required to prevent displacement.
   c. Replant bare areas using same materials specified for lawns.

2. Watering: If irrigation has not been installed, provide and maintain temporary piping, hoses, and lawn watering equipment to convey water from sources and to keep lawn areas uniformly moist as required for proper growth. Lay out temporary lawn watering system and arrange watering scheduling to avoid walking over muddy or newly seeded areas. Use equipment and water in such a way as to prevent puddling, water erosion, and displacement of seed or mulch.
3. Initial lawn mowing shall occur when grass reaches a height of 3 inches or by November 1st, whichever comes first. Mowing shall be discontinued during winter months while lawn is dormant. Continue mowing in the spring. Time the subsequent mowings to maintain the grass at 1 ½" to encourage continued germination of bluegrass seedlings without shading by germinated grass. Mowing should occur on approximate 5 day intervals for the first 6 weeks after the initial spring mowing. Do not allow grass height to become longer than 2 1/8". Mowing shall be accomplished with a reel mower in good working order with sharp blades and bed knives and without fluid leaks. At six weeks, gradually increase the height of cut by ¼" per mowing until final mowing height of 2 ½" is achieved. An increase in cutting height of ¼' shall not occur in less than 5 days. As the mowing height increases, the length of time between cuts or mowings may increase, but not more than 1/3 of the grass height should ever be removed at one time.

a. Apply fertilizer after first mowing and when the grass is dry. Use fertilizer which will provide 0.5 lb. of actual nitrogen per 1,000 s.f. of lawn area.
b. Apply a second application of fertilizer at the beginning of the spring growing season at a rate of ¾ lb. actual nitrogen per 1,000 s.f. of lawn area. Apply when the grass is dry.
c. Apply a third application of fertilizer at 6 weeks after the initial spring mowing at a rate of ¾ lb. actual nitrogen per 1,000 s.f. of lawn area. Apply when the grass is dry.

3.6 FINAL ACCEPTANCE OF LAWNS:

A. General:

1. Seeded lawns will be acceptable provided requirements, including maintenance, have been complied with and healthy, uniform close stand of specified grass is established, free of weeds, disease, insects, bare spots and surface irregularities.
2. No lawn will be accepted prior to 60 days from its installation and 6 mowings (minimum).

B. Inspections:

1. Preliminary Inspection for Final Acceptance:

a. Prior to granting final acceptance, a preliminary inspection for acceptance will be made by the Owner's Representative to determine that all lawns and all other required and related work is in place and that it has been installed in accordance with the drawings and specifications.

2. Inspection for Final Acceptance:

a. A final inspection for acceptance of all lawns will be held after all adjustments required by the preliminary inspection for acceptance have been made. The Contractor shall notify the Owner's Representative in writing, requesting an inspection to grant final acceptance.
b. At the discretion of the Owner, final acceptance may be granted to individual areas. Any such agreements shall be determined at the pre-installation meeting.
c. Following acceptance, the Owner shall assume responsibility for all lawn maintenance.

End of Section 32 92 00