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ATHLETIC FACILITY IMPROVEMENTS AT AVON HIGH SCHOOL
AVON, CONNECTICUT

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DIVISION 01
GENERAL CONDITIONS

SECTION 01 1401

PRESERVATION AND RESTORATION OF SITE FEATURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes

1. Protection restoration of existing improvements.

2. Restoration of existing improvements.

B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

PART 2 PRODUCTS

2.1 TREE PROTECTION FENCING

A. Tree protection shall be as shown on the Drawings.

PART 3 EXECUTION

3.1 IDENTIFICATION OF EXISTING FEATURES

A. Prior to commencing construction activities, Contractor shall identify and delineate those areas or specific improvements that are not to be disturbed. Areas or specific improvements within the Limits of Work/Contract Limits and general work areas which are not to be disturbed shall be clearly marked or fenced. Monuments and markers shall be protected before construction operations commence. Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting designated areas, specific improvements, monuments, and markers at the Project Site.

B. Prior to commencing construction activities, Contractor shall conduct a "walk-down" of the Project Site with Engineer and/or Owner. The purpose of such "walk-down" is to document pre-construction conditions of items/areas of concern.

1. Contractor shall make note of any damage visible on items/areas of concern, with reference to specific location.

2. [Engineer or Owner must be present for "walk-down" to be considered valid.]

3.2 PROTECTION OF EXISTING FEATURES

A. General

1. All areas or specific improvements, including but not limited to vegetation, utilities, poles, wires, fences, curbings, property-line markers, and other structures, which must be preserved in place without being temporarily or permanently relocated shall be carefully supported and otherwise protected from damage by Contractor.

2. As excavation approaches underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools.

B. Pavements

1. On paved surfaces to remain, Contractor shall not use or operate tractors, bulldozers, or other power-operated equipment, or store tools, equipment or materials which may cut or otherwise damage such surfaces.

2. All surfaces, which have been damaged by Contractor's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of construction operations. Such restoration shall meet the approval of Engineer.

C. Utilities

1. Safeguard and protect from damage any utility to remain in service. Before excavating near any utility, notify the utility owner, coordinate protective work, and comply with the utility owners' requirements.

2. All utility services shall be supported by suitable means so that the services shall not fail when tamping and settling occurs.

3. Where known utilities are encountered, notify Engineer and document location and type of utility before proceeding with work in such area.

4. When uncharted or incorrectly charted utilities are encountered, stop work and notify Engineer. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.

D. Retaining Structures: Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utility systems, paving, or other improvements. Contractor assumes responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto.

3.3 REPLACEMENT

A. In case of damage, Contractor shall notify the appropriate party so that proper steps may be taken to repair any and all damage done. When the Owner does not wish to make the repairs themselves, all damage shall be repaired by Contractor, or, if not promptly done by him, Engineer may have the repairs made at the expense of Contractor.

B. Contractor shall patch, repair and/or replace all adjacent materials and surfaces damaged through the prosecution of work at no expense to Owner. All repair and replacement work shall match the existing in-kind. Final acceptance of said work shall be at the sole judgement of Owner.

3.4 RELOCATION

A. If certain existing structures are encountered that in the opinion of Engineer require temporary or permanent relocation or removal, Engineer may order in writing that Contractor undertake all or part of such work or to assist the Owner in performing such work. For such occurrences, Contractor shall be compensated as applicable, as extra work.

1. In removing existing structures, Contractor shall use care to avoid damage to the material, and Engineer shall include for payment only those new materials, which, in his judgment, are necessary to replace those unavoidably damaged.

B. The structures to which the provisions of the preceding two paragraphs shall apply include structures which (1) are not indicated on the drawings or otherwise provided for, (2) encroach upon or are encountered near and substantially parallel to the edge of the excavation, and (3) in the opinion of Engineer will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced. (See Item 3.19, "Sub-Surface Obstructions" also). Contractor shall protect items/areas of concern:

3.5 LAND RESOURCES

A. Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, Contractor shall identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval. Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subarticles.

B. Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. Contractor shall restore any such landscape features damaged or destroyed during construction operations.

1. Trees which are to remain are shown on the Drawings. Unless specifically authorized by Engineer, no construction equipment or materials shall be placed or used within the drip line of trees shown on the drawings to be saved/to remain. No excavation or fill shall be permitted within the drip line of trees to be saved/to remain except as approved by Engineer.

2. No ropes, cables, or guys shall be fastened to or attached to any tree(s) for anchorage unless specifically authorized by Engineer. Where such special use is permitted, Contractor shall provide effective protection to prevent damage to the tree.

3.6 WIND PROTECTION

A. Should high wind warnings be issued by the U.S. Weather Bureau, Contractor shall take every precaution to minimize danger to persons, to the work, and to adjacent properties.

3.7 TREE PROTECTION FENCING

A. Install fencing completely around all trees to be protected within the project area as shown on the Drawings or as directed by Engineer. Install fencing before any construction activities commence and maintain in place until final grading and seeding is complete and accepted.

B. Contractor shall not place, or stockpile, any construction or excavation materials within the drip line of any trees. Vehicle and construction equipment shall not be parked, nor left running (idling), within the drip line of any tree.

C. Any excavation within the drip line of trees to be protected shall be performed by hand, unless otherwise directed by Engineer.

D. Where construction equipment must pass within the drip line of trees to remain, Contractor shall install wooden tree protection on the trunk of the tree, as detailed, and as directed by Engineer.

E. Where excavation requires the cutting of tree roots, roots shall be cut with sharp cutting tools and reburied as soon as possible. Until roots can be reburied, the exposed roots are to be covered with wet burlap to prevent roots from drying out. The burlap is to be kept wet until the roots can be reburied.

F. Where cutting of tree root system has occurred, Contractor shall water the tree root system to the extent of the tree canopy with at least ½ inch of water within 72 hours of when the damage occurred.

G. When less than ½ inch of water has fallen during a 7-day period, Contractor shall water the tree root system to the extent of the tree canopy with at least ½ inch of water.

H. Trees damaged by construction activities are to be repaired within 72 hours using current arboricultural standards. Those trees determined by Engineer to be damaged beyond repair shall be removed and replaced by Contractor at no additional cost to Owner.

END OF SECTION

SECTION 01 2000

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 BASIS OF PAYMENT

A. Payments to the Contractor shall be based upon the lump sum and unit prices provided by the Contractor on the Bid Sheet. All payments will be made to the Contractor in accordance with the terms and conditions of the Contract between the Contractor and Owner.

B. The Contractor shall submit Applications for Payment at a frequency of no greater than once per month. Applications for payment shall state the period covered and contain a listing of the Work items for which payment is being requested, percentages complete for lump sum items or quantities completed for unit price items, and a summary of billings to date (by Work item) and payments made. Applications for payment shall be reviewed by the Engineer and approved by the Owner.

C. For lump sum payment items, progress payments to the Contractor shall be based upon the percentage complete of the lump sum tasks. The estimate shall be based on the approximate quantity of Work completed in accordance with the Contract Plans and Specifications. Estimates of the percentage of lump sum items complete shall be submitted with the Application for Payment. If appropriate, the Owner may request backup documentation to support partial payment of lump sum items. Such documentation may include vendor invoices or personnel timesheets.

D. For unit price items, payment to the Contractor shall be based upon the actual quantity of Work completed and accepted by the Owner.

E. The Contractor shall accept payment as full compensation for furnishing all materials, labor, tools, equipment, and incidentals necessary to complete the Work and for performing all Work contemplated and embraced by the Contract and the Bid Documents.

1.2 MEASUREMENT OF QUANTITIES

A. Work of this project which shall be measured for payment on a unit basis is indicated in the Specifications.

B. The quantities of various items in the Work may be subject to modification based upon actual site conditions. The costs associated with the modifications will be based on the unit prices included in the Contractor's Bid as indicated on the Bid Form, or by negotiated agreement between the Contractor and the Owner.

C. Items based upon volume

1. Unless otherwise specified herein, unit prices for excavation based on "Volume" will be based on in-place volumes (in cubic yards: CY) before excavation or following placement and compaction of backfill. In-place excavation volumes will be determined in the field by the Contractor's surveyor. The Contractor will submit his measurements and calculations to the Engineer to assist in the review and approval of Contractor invoices.

2. For progress payments of unit price items based on volume, the volumes of materials shall be estimated as described above or by interim surveys of stockpile areas or excavations (as appropriate). Application for payment shall include sufficient documentation to allow the Owner and Engineer to review the accuracy of progress payment applications.

3. Contract items based on volume shall be measured by the Contractor's registered land surveyor as described herein. The payment quantity computations will be reviewed by the Owner and/or Engineer to determine progress payments and to determine final quantities of Work in place prior to the final approval and payment under the contract.

D. Items Based on Weight

1. Unless otherwise specified herein, unit prices based on "Weight" will be based on the weight of material (in pounds or tons) as determined using certified scales. Certification documentation will be provided to the Engineer upon request.

E. Items Based on Area

1. Unless otherwise specified herein, unit prices are based on "Area" will be based on the actual area (in square feet or yards) as measured by the Contractor's registered land surveyor. The Contractor will submit his calculations to the Engineer to assist in the review and approval of Contractor invoices.

2. For progress payments of unit price items based on area, the area shall be estimated by interim surveys. Application for payment shall include sufficient documentation to allow the Owner and Engineer to review the accuracy of progress payment applications.

1.3 APPLICATION FOR PAYMENT

A. On the 25th of each month submit an itemized Application of Payment to Owner, with all required supporting documents, covering the Work completed as of the date of the Application for Payment.

B. Form of Submittal: Submit Schedule of Values on AIA Document G702, Application and Certificate for Payment, or computer generated form of the same style acceptable to Engineer.

C. Submit a progress schedule update with each Application for Payment.

D. When Owner requires substantiating data, Contractor shall submit suitable information with cover letter identifying Application of Payment number and date, line item by number and description.

E. Progress Payments

1. Progress payments shall be made to Contractor in accordance with the terms of the Contract between the Contractor and the Owner.

2. Progress payments will be based upon progress estimates by Contractor and verified by Engineer of the actual physical progress of the work, utilizing the Schedule of Values approved by Engineer.

1.4 ELIMINATED CONTRACT ITEMS

A. Incidental work shall be defined as all work not otherwise specified but obviously necessary for the proper completion of the work as specified and shown the Drawings.

B. The Contractor shall be responsible for all incidental work items. The Owner may eliminate any items of Work, or portions of Work from the contract as deemed to be in the Owner's interest. Such action shall in no way invalidate the Contract. No payment shall be made to the Contractor for anticipated profits from Work that is eliminated from the contract by the Owner.

1.5 INCIDENTAL WORK

A. Incidental work items for which payment is not measured or made include, but are not limited to:

1. Protection in-place all existing utilities and structures;

2. Implementation of standard health and safety requirements specific to each Work task (e.g., personal protective equipment, support equipment, monitoring personnel, etc.);

3. Clean up; and

4. Cooperation with other Contractors.

1.6 RETAINAGE

A. The Owner shall retain payments valued at ten (10) percent of the total project cost until the requirements of Section 01 7700 – Project Close-Out have been met to the satisfaction of the Engineer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 2010

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Definition and description of measurement and payment criteria for the Bid Items to be used for the work.

B. Refer to the Bid Form for the preparation of bid pricing in conjunction with this Section.

1.2 MEASUREMENT OF QUANTITIES

A. Lump Sum Items - No quantities will be measured. The work is to be completed as a complete functional system as shown on the Drawings and as called for in the Specifications. Refer to individual Bid Items.

B. Unit Price Items - Unit price items will be used for the sole purpose of quantifying those items defined as being paid on a unit price basis and quantities will be measured as indicated herein. Unit Prices are totally inclusive of whatever is required to complete each item in its entirety, including but not limited to all overhead, profit, sales tax, estimating, engineering, design, detailing, shop drawings, submittals, delivery, layout, furnishing, installing and all associated incidentals thereto.

1. Measurement by Volume – Measured by cubic dimension using mean length, width, and height or thickness. Unless specified otherwise, volumes shall be computed using the average-end-area method with cross sections surveyed at maximum 100-foot spacing. On curved alignments, volume computations shall utilize the length between the centroid of each area at adjacent cross sections rather than the nominal cross section spacing along the alignment.

a. Measurement will be made from the limit of the neat lines shown on the Drawings or to the approved limits of excavation.

2. Measurement by Area – Measured by square dimensions using mean length, width, or radius as applicable.

3. Linear Measurements.

a. Measured by linear dimension at the item centerline or mean chord.

b. Based on a horizontal projection of the actual length except where specified as a vertical measurement.

4. Engineer will perform field measurements and calculations to measure installed quantities for all Unit Price pay items as indicated in the individual Bid Items in conformance with applicable specification sections.

5. Notify Engineer in advance of work performed under Unit Price Items.

1.3 BASE BID ITEM DESCRIPTIONS

A. Bid Item 1 – Site Preparation and Demolition

1. Contractor shall perform all work as shown on the Drawings and called-for in the Specifications to include the following:

a. Mobilization, Site Preparation, and Close-out: Mobilize all necessary personnel, tools and equipment; prepare the Project Site as shown on the Drawings, as called-for in the Specifications, and as required to complete the work in a safe and controlled manner; establish and maintain temporary facilities or work practices as shown on the Drawings, as called-for in the Specifications, and as required to complete the work including, but not necessarily limited to, administrative facilities, fencing, barriers, warming signs, erosion and sedimentation controls and related facilities. At the conclusion of work restore and stabilize affected areas and fully demobilize all temporary facilities, equipment, and materials; complete close-out as shown on the Drawings and as called-for in the Specifications.

b. Site Demolition: Demolish and completely remove those improvements and appurtenances as called-for in the Specifications and/or shown on the Drawings. Provide for the off-site removal and legal disposal of all demolition waste and excess materials.

c. Incidental work: Contractor shall include in his price for this Bid Item all incidental work items required to complete the work as shown on the Drawings and as called-for in the Specifications. Incidental work shall be defined as all work not otherwise specified but obviously necessary for the proper completion of the work, including, but not necessarily limited to, permitting, fees, meetings, performance-based design, submittals, construction layout, measurements, testing, inspections, general project coordination, health and safety, and project documentation.

2. Measurement

a. This item will be measured for payment on a Lump Sum basis.

3. Payment

a. The Lump Sum payment under this item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payment for this lump sum item will be made based on the percentage of work completed, as determined by Engineer.

B. Bid Item 2 – Field Drainage and Base Preparation

1. Contractor shall perform all work as shown on the Drawings and called-for in the Specifications to include the following:

a. Site Grading: Provide all required clearing, material import/export, earthwork, grading, filling, and testing of earth materials to the lines and grades depicted on the Drawings prior to the installation of the drainage base.

b. Field Base: Provide for an all-stone field base including the removal of existing topsoil and other sub-soil as required for field construction; separation/segregation of topsoil from other soil materials; stockpiling of topsoil required for site restoration; off-site disposal of surplus sub-soil; transport of excess topsoil beyond that quantity required for site restoration to the designated off-site location within the Town of Avon as indicated by Owner; installation of controlled fill, installation of drainage flat panels, field base bottom stone; grading, compaction, and finishing, to the lines and grades depicted on the Drawings to achieve a complete functional system.

c. Site Drainage: Provide for the installation of site drainage as indicated on the Drawings and called-for in the Specifications, including drainage, collector drain trenching, manholes, and all other associated drainage work.

d. Incidental work: Contractor shall include in his price for this Bid Item all incidental work items required to complete the work as shown on the Drawings and as called-for in the Specifications. Incidental work shall be defined as all work not otherwise specified but obviously necessary for the proper completion of the work, including, but not necessarily limited to, permitting, fees, meetings, supplier coordination, performance-based design, submittals, construction layout, measurements, testing, inspections, general project coordination, health and safety, and project documentation.

2. Measurement

a. This item will be measured for payment on a Lump Sum basis.

3. Payment

a. The Lump Sum payment under this item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payment for this lump sum item will be made based on the percentage of work completed, as determined by Engineer.

C. Bid Item 3 – Synthetic Grass Sports Surfacing

1. Contractor shall perform all work as shown on the Drawings and called-for in the Specifications to include the following:

a. Synthetic Grass Sports Surfacing: Provide for the installation of synthetic grass sports surfacing system and resilient padding as indicated on the Drawings and called-for in the Specifications. Provide a qualified install as depicted in the Specifications, install those system components identified in the Specifications, and install those system components not specified, but required to achieve a complete functioning system.

b. Synthetic Grass Sports Surfacing Performance Testing: Provide for the performance testing of the synthetic turf system as identified in the Specification. Testing to be completed by a certified testing agency as depicted in the Specifications.

c. Incidental work: Contractor shall include in his price for this Bid Item all incidental work items required to complete the work as shown on the Drawings and as called-for in the Specifications. Incidental work shall be defined as all work not otherwise

specified but obviously necessary for the proper completion of the work, including, but not necessarily limited to, permitting, fees, meetings, supplier coordination, performance-based design, submittals, construction layout, measurements, testing, field performance testing, inspections, general project coordination, health and safety, and project documentation.

2. Measurement

   a. This item will be measured for payment on a Lump Sum basis.

3. Payment

   a. The Lump Sum payment under this item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payment for this lump sum item will be made based on the percentage of work completed, as determined by Engineer.

D. Bid Item 4 – All-Weather Track Construction

1. Contractor shall perform all work as shown on the Drawings and called-for in the Specifications to include the following:

   a. Base Installation: Provide all required material import/export, earthwork, grading, filling, and testing of earth materials as shown on Drawing details and to the lines and grades shown on the Drawings.

   b. Track Construction: Provide for the installation of bituminous pavement track surface as shown on the Drawings and as called-for in the specifications.

   c. All-Weather Track: Provide for the installation of all-weather track surfacing and markings as indicated on the Drawings and events surfacing and markings as indicated on the Drawings. Provide a qualified install as depicted in the Specifications, install those system components identified in the Specifications, and install those system components not specified, but required to achieve a complete functioning system.

   d. Incidental work: Contractor shall include in his price for this Bid Item all incidental work items required to complete the work as shown on the Drawings and as called-for in the Specifications. Incidental work shall be defined as all work not otherwise specified but obviously necessary for the proper completion of the work, including, but not necessarily limited to, permitting, fees, meetings, supplier coordination, performance-based design, submittals, construction layout, measurements, testing, inspections, general project coordination, health and safety, and project documentation.

2. Measurement

   a. This item will be measured for payment on a Lump Sum basis.

3. Payment

   a. The Lump Sum payment under this item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials,

supplies, supervision and other fees required for the work. Payment for this lump sum item will be made based on the percentage of work completed, as determined by Engineer.

E. Bid Item 5 – Site Improvements

1. Contractor shall perform all work as shown on the Drawings and called-for in the Specifications to include the following:

a. Site Improvements Construction: Provide for the installation of site improvements as indicated on the Drawings and called-for in the Specifications, including, but not limited to, field water supply and associated appurtenance, electrical conduit and handholes, bituminous paving of walkways, drives, and parking areas, retaining wall construction; fencing and guardrails; prefabricated storage shed; loam and seed; and all other associated work to complete the project. Coordinate with local authorities and utility providers as required, and install all utility systems in accordance with the standards of each utility owner

b. Incidental work: Contractor shall include in his price for this Bid Item all incidental work items required to complete all the base bid work as shown on the Drawings and as called-for in the Specifications that is not otherwise noted in bid items 1 through 5. Incidental work shall be defined as all work not otherwise specified but obviously necessary for the proper completion of the work, including, but not necessarily limited to, permitting, fees, meetings, performance-based design, submittals, construction layout, measurements, testing, inspections, general project coordination, health and safety, and project documentation.

2. Measurement

a. This item will be measured for payment on a Lump Sum basis.

3. Payment

a. The Lump Sum payment under this item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payment for this lump sum item will be made based on the percentage of work completed, as determined by Engineer.

1.4 UNIT PRICE BID ITEMS

A. Bid Item 6 – Top Soil Removal

1. Description: At the direction of Engineer, Contractor shall perform all work associated with the removal of topsoil beyond the pay limits indicated on the Drawings to include topsoil removal, staging, stockpiling, loading and transport to the designated off-site location as shown on the Drawings and called for in the Specifications.

a. Measurement – This Unit Price item will be measured for payment on a Per Cubic Yard basis as the actual in-ground/in-place volume of topsoil excavated, based on dimensional measurements of the excavation, beyond the pay limits indicated on the

Drawings that is removed, staged, stockpiled, loaded and transported to the designated off-site location.

b. Payment – Payment under this Unit Price item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payments under this item will be made based on the number of cubic yards of topsoil removed multiplied by the unit rate (per Cubic Yard) bid.

B. Bid Item 7 – Removal of Unsuitable Soil

1. Description: At the direction of Engineer, Contractor shall perform all work associated with the removal of Unsatisfactory Material to include excavation, handling, staging, stockpiling, loading, off-site transport, and disposal.

a. Measurement - This Unit Price item will be measured for payment on a Per Cubic Yard basis as the volume of Unsatisfactory Material excavated, handled, staged, stockpiled, loaded, transported off-site, and disposed. The volume of such material will be based on the actual in-ground/in-place dimensional measurements of the excavation resulting from the removal of Unsatisfactory Material.

b. Payment - Payment under this Unit Price item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payments under this item will be made based on the number of cubic yards of Unsatisfactory Material removed multiplied by the unit rate (per Cubic Yard) bid.

C. Bid Item 8 – Test Pit Excavations

1. Description: Conduct exploratory excavations in accordance with Specification Section 02 3219 – Exploratory Excavations.

a. Measurement – This Unit Price item will be measured for payment on a Per Hour basis, measured as the actual number of hours of exploratory excavation work completed.

b. Payment – Payment under this item will be considered full compensation, including Contractor's overhead and profit, for all layout, labor, equipment, materials, supplies, supervision and other fees required for the work. Payment for this unit price item will be made based on the actual number of hours of exploratory excavation work completed, as determined by Engineer multiplied by the unit rate (per hour) bid.

D. Bid Item 9 – Common Fill

1. Description: At the direction of Engineer, Contractor shall perform all work associated with the placement and compaction of Common Fill where other soils have been removed at the direction of Engineer, to include procurement, transport, unloading, movement, placement, and compaction in designated areas.

a. Measurement - This Unit Price item will be measured for payment on a Per Cubic Yard basis as the volume of Common Fill placed. The volume of such material will

be based on the actual in-ground/in-place dimensional measurements of the Common Fill after placement and compaction.

b. Payment - Payment under this Unit Price item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payments under this item will be made based on the number of cubic yards of Common Fill placed and compacted multiplied by the unit rate (per Cubic Yard) bid.

E. Bid Item 9 – Granular Fill

1. Description: At the direction of Engineer, Contractor shall perform all work associated with the placement and compaction of Granular Fill where other soils have been removed at the direction of Engineer, to include procurement, transport, unloading, movement, placement, and compaction in designated areas.

a. Measurement - This Unit Price item will be measured for payment on a Per Cubic Yard basis as the volume of Granular Fill placed. The volume of such material will be based on the actual in-ground/in-place dimensional measurements of the Granular Fill after placement and compaction.

b. Payment - Payment under this Unit Price item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payments under this item will be made based on the number of cubic yards of Granular Fill placed and compacted multiplied by the unit rate (per Cubic Yard) bid.

1.5 ALTERNATE BID ITEMS

A. All Alternate Bid Items include Incidental work. Contractor shall include in his price for each Alternate Bid Item all incidental work items required to complete the work as shown on the Drawings and as called for in the Specifications.

1. Incidental work shall be defined as all work not otherwise specified but obviously necessary for the proper completion of the work, including, but not necessarily limited to, permitting, fees, meetings, assessment, performance-based design, submittals, construction layout, measurements, testing, inspections, subcontractors, general project coordination, health and safety, and project documentation.

B. Alternate Bid Item 1 - Sports Field and Pedestrian Lighting

1. Description: Contractor shall perform all work as shown on the Drawings and called-for in the Specifications to include the following:

Lighting Systems: Provide for the installation of sports field lighting and pedestrian lighting as shown on the Drawings, including trenching, foundations/bases, light poles, light towers, luminaries, power supplies, circuitry, control systems, foundations, testing, and commissioning. Provide a licensed electrician and other specialty installers to install all components of the lighting systems, and to install those system components identified in the Specifications and shown on the Drawings, and install those system components not specified, but required to achieve complete functioning systems in accordance with all applicable codes. Provide for all required testing, inspection, and commissioning.

Field Power Supply: Provide GFCI -protected 120-volt circuit(s) to the field in conduit as shown on the Drawings and as called-for in the Specifications including all required connections to existing panel, breaker(s), wiring, grounding, splices, connectors, handholes, boxes, receptacles, and other appurtenances required to achieve a complete functioning system. Provide for all required testing, inspections, and commissioning.

Incidental Work: Contractor shall include in his price for this Bid Item all incidental work items required to complete the work as shown on the Drawings and as called for in the Specifications. Incidental work shall be defined as all work not otherwise specified but obviously necessary for the proper completion of the work, including, but not necessarily limited to, permitting, fees, meetings, performance-based design, submittals, construction layout, measurements, testing, inspections, general project coordination, health and safety, and project documentation.

a. Measurement - This item will be measured for payment on a Lump Sum basis.

b. Payment - The Lump Sum payment under this item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payment for this lump sum item will be made based on the percentage of work completed, as determined by Engineer. Bid Item 8 - Sports Field and Pedestrian Lighting

C. Alternate Bid Item 2 - Sports Field and Pedestrian Lighting, Extended Construction Schedule

1. Description: Contractor shall perform the work Under Alternate Bid Item 1 after August 23, 2019 and up to 180 days thereafter.

a. Measurement - This item will be measured for payment on a Lump Sum basis.

b. Payment - The Lump Sum payment under this item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payment for this lump sum item will be made based on the percentage of work completed, as determined by Engineer.

D. Alternate Bid Item 3 - Landscape Plant Buffer, West Avon Road and Sudbury Way

1. Contractor shall perform all work as shown on the Drawings and called-for in the Specifications for the installation of a landscape buffer at West Avon Road and Sudbury Way.

Incidental Work: Contractor shall include in his price for this Bid Item all incidental work items required to complete the work as shown on the Drawings and as called for in the Specifications. Incidental work shall be defined as all work not otherwise specified but obviously necessary for the proper completion of the work, including, but not necessarily limited to, permitting, fees, meetings, performance-based design, submittals, construction layout, measurements, testing, inspections, general project coordination, health and safety, and project documentation.

a. Measurement - This item will be measured for payment on a Lump Sum basis.

b. Payment - The Lump Sum payment under this item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payment for this lump sum item will be made based on the percentage of work completed, as determined by Engineer.

E. Alternate Bid Item 4 - Landscape Plant Buffer, Southeast

1. Contractor shall perform all work as shown on the Drawings and called-for in the Specifications for the installation of a landscape buffer at the southeast location indicated.

Incidental Work: Contractor shall include in his price for this Bid Item all incidental work items required to complete the work as shown on the Drawings and as called for in the Specifications. Incidental work shall be defined as all work not otherwise specified but obviously necessary for the proper completion of the work, including, but not necessarily limited to, permitting, fees, meetings, performance-based design, submittals, construction layout, measurements, testing, inspections, general project coordination, health and safety, and project documentation.

a. Measurement - This item will be measured for payment on a Lump Sum basis.

b. Payment - The Lump Sum payment under this item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payment for this lump sum item will be made based on the percentage of work completed, as determined by Engineer.

F. Alternate Bid Item 5 - Landscape Plant Buffer, North Field

1. Contractor shall perform all work as shown on the Drawings and called-for in the Specifications for the installation of a landscape buffer at the north athletic field at the location indicated.

Incidental Work: Contractor shall include in his price for this Bid Item all incidental work items required to complete the work as shown on the Drawings and as called for in the Specifications. Incidental work shall be defined as all work not otherwise specified but obviously necessary for the proper completion of the work, including, but not necessarily limited to, permitting, fees, meetings, performance-based design, submittals, construction layout, measurements, testing, inspections, general project coordination, health and safety, and project documentation.

a. Measurement - This item will be measured for payment on a Lump Sum basis.

b. Payment - The Lump Sum payment under this item will be considered full compensation, including Contractor's overhead and profit, for all labor, equipment, materials, supplies, supervision and other fees required for the work. Payment for this lump sum item will be made based on the percentage of work completed, as determined by Engineer.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2973

SCHEDULE OF VALUES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Preparation and submittal of a Schedule of Values.

2. Updating Schedule of Values.

1.2 DEFINITIONS

A. The Schedule of Values is an itemized list that establishes the value of each part of the Work for a stipulated price contract and for major lump sum items in a unit price contract. The Schedule of Values is used as the basis for preparing applications for payments. Quantities and unit prices may be included in the schedule when designated by Engineer.

1.3 SCHEDULE OF VALUES SUBMITTAL

A. Submit a Schedule of Values to Engineer within ten (10) days of executing an Agreement with Owner. Upon Engineer's request, Contractor will provide supportive data substantiating their correctness. Use Schedule of Values only as basis for Contractor's Application for Payment.

B. Form of Submittal: Submit Schedule of Values on AIA Document G703, or computer generated form of the same style, using Table of Contents of these Specifications as basis for format for listing costs of work for all Divisions.

C. Identify each line item with number and title as listed in Table of Contents in these Specifications. Each line item shall be identified with number and title of the specification section, value, and quantities (if requested).

1. Itemize separate line item cost, at a minimum, for each of the following general cost items:

a. Performance and Payment Bonds

b. Mobilization

c. Temporary facilities and controls.

d. Erosion and sedimentation controls

e. Field supervision and construction layout

f. Parking revisions and pedestrian walkways

g. Electrical and communications conduit, in-place.

h. Retaining Wall

i. Synthetic turf field - earthwork, base, and drainage

j. Synthetic turf field - synthetic turf system and infill

k. Running track and field events- earthwork and bituminous concrete base

l. Running track and field events- Surfacing system and markings

m. Storage Building

n. Field Lighting

o. Pedestrian Lighting

p. Field Equipment

2. Line items including Subcontract work shall be subdivided so as to indicate value of such work.

3. For each line item which has installed value of more than $25,000 break-down costs to list major products for operations under each item, rounding figures to nearest dollar.

D. Make sum of total costs of all items listed in Schedule equal to total Contract Sum.

1.4 REVIEW AND RESUBMITTAL

A. After Engineer's review and approval, the Schedule of Values shall be reviewed and approved by the bonding company (if applicable). A letter of approval from the bonding company (if applicable) approving the Schedule of Values shall accompany the final submittal of the Schedule of Values to Engineer.

B. Payment based on the Schedule of Values shall not be until all approvals are obtained. If requested, revise and resubmit Schedule of Values until approvals are obtained.

1.5 MODIFICATIONS

A. During progress of the Work, the Schedule of Values as approved by Owner shall be modified to reflect changes in the Contract Sum due to Change Orders or other modifications of the Contract. Such updated Schedule of Values shall be used for Applications for Payment.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. General coordination procedures.

2. Coordination drawings.

3. Requests for Information (RFIs).

B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 SUBMITTALS

A. Contractor Personnel

1. Prior to the start of construction, submit a list of key Contractor personnel, including site superintendent, project manager, and other key personnel on the project team and/or at the Project Site. Include the following information in tabular form:

a. Individuals' name and their duties and responsibilities

b. Field office and/or home office mailing address

c. Office or field office telephone number(s),

d. Cellular telephone number

e. E-mail address. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

B. Subcontractor List

1. Prepare a written summary identifying individuals or firms proposed for each portion of the work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

a. Name, address, and telephone number of entity performing subcontract or supplying products.

b. Number and title of related Specification Section(s) covered by subcontract.

c. Drawing number and detail references, as appropriate, covered by subcontract.

C. Post copies of lists in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.3 GENERAL COORDINATION PROCEDURES

A. Contractor shall supervise and direct the Work, using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract and for safety, as well as conformity and timeliness of all portions of the Work.

B. Contractor's Superintendent

1. Contractor shall employ and assign a competent Superintendent whose qualifications shall be acceptable to Owner. Superintendent shall serve on a full-time basis at the Project Site and shall be authorized to act on behalf of Contractor in all matters related to the Work.

2. The same person shall continue in the capacity of Superintendent until the Work has been completed, the Superintendent ceases to be employed by Contractor, or the Superintendent becomes sick or disabled. If at any time the Superintendent is not satisfactory to Owner, Contractor shall, if requested by Owner, replace the Superintendent with another satisfactory to Owner.

3. The Superintendent or his designated representative must be present at the Project Site at all times when on-site Work is performed.

C. Coordinate work included in different Specification Sections and/or on different Drawings to ensure efficient and orderly installation of each component of the work, to ensure coordination of those project elements that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the work depends on completion or installation of other parts of the work.

2. Coordinate completion of work and/or installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

D. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

E. Contractor shall ensure that each Subcontractor shall coordinate its construction operations with those of other Subcontractors and entities to ensure efficient and orderly installation of each part of the work. Contractor and each Subcontractor shall coordinate their respective operations with other operations included in different Specification Sections and/or Drawings that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

F. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their work is required.

G. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.

2. Preparation of the schedule of values.

3. Installation and removal of temporary facilities and controls.

4. Delivery and processing of submittals.

5. Progress meetings.

6. Pre-installation conferences.

7. Project closeout activities.

8. Startup and adjustment of systems.

H. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.4 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the

information and resolution of conflicts between installed components before submitting for review.

c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.

f. Indicate required installation sequences.

g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.5 REQUESTS FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.

2. Project number.

3. Date.

4. Name of Contractor.

5. Name of Engineer.

6. RFI number, numbered sequentially.

7. RFI subject.

8. Specification Section number and title and related paragraphs, as appropriate.

9. Drawing number and detail references, as appropriate.

10. Field dimensions and conditions, as appropriate.

11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: If not provided by Engineer, utilize a Contractor-provided form that meets Engineer's approval.

D. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow seven (7) working days for Engineer's response for each RFI.

1. The following Contractor-generated RFIs will be returned without action:

a. Requests for approval of submittals.

b. Requests for approval of substitutions.

c. Requests for approval of Contractor's means and methods.

d. Requests for coordination information already indicated in the Contract Documents.

e. Requests for adjustments in the Contract Time or the Contract Sum.

f. Requests for interpretation of Engineer's actions on submittals.

g. Incomplete RFIs or inaccurately prepared RFIs.

2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.

3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to the Agreement and/or applicable Division 1 Specifications.

4. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer and Owner in writing within 5 working days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log to Engineer weekly. At a minimum, include the following:

1. Project name.

2. Name and address of Contractor.

3. Name and address of Engineer.

4. RFI number including RFIs that were returned without action or withdrawn.

5. RFI description.

6. Date the RFI was submitted.

7. Date Engineer's response was received.

F. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within five (5) working days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 3119

PROJECT MEETINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes

1. Pre-Construction Meeting.
2. Pre-Installation Meetings.
3. Coordination Meetings.
4. Progress Meetings.
5. Health and Safety Meetings.

1.2 GENERAL

A. The purpose of project meetings is to provide a routine forum for discussing and resolving job-related problems, scheduling work activities, discussing changes, reviewing shop drawing status, reviewing health and safety issues, Change Order status and other requirements. Specific direction for necessary action will be given at these meetings and followed up at succeeding meetings. It is important, therefore, that personnel attending these meetings are authorized to respond and commit to the obligations of the Subcontractor or Vendor.

1.3 PRE-CONSTRUCTION MEETING

A. Engineer will schedule a pre-construction meeting at the Project Site before starting construction. This preconstruction meeting is intended to establish lines of communication between the parties involved, review responsibilities and personnel assignments, establish project schedules, discuss proposed performance methods, and coordinate Work to be performed by Contractor. The date and time of the preconstruction meeting shall be determined after the Agreement has been executed by Owner and Contractor.

B. Meeting Attendees: Authorized representatives of Owner, Engineer and their consultants; the Contractor and its Superintendent(s), Subcontractors and all others invited by the Contractor, shall attend the pre-construction meeting. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the work.

C. Basic Agenda: Discuss items of significance at the pre-construction meeting that could affect progress including at least the following:

1. Tentative construction schedule
2. Scope of the Work
3. Critical Work sequencing
4. Testing

5. Regulatory requirements
6. Designation of responsible personnel
7. Procedures for processing field decisions and Change Orders
8. Procedures for processing Applications for Payment
9. Distribution of Contract Documents
10. Preparation of record documents
11. Use of the premises and work restrictions
12. Office, work and storage areas
13. Equipment deliveries
14. Construction safety
15. Security
16. Housekeeping
17. Working hours

D. Report of Meeting: After the Pre-Construction Conference, Engineer will distribute copies of minutes of the meeting to Contractor, and to each party present. Contractor shall distribute copies to other parties who should have been present or who are affected by decisions or actions resulting from the meeting, but did not attend the meeting.

1.4 PRE-INSTALLATION MEETINGS

A. Conduct a Pre-Installation Meeting at the Project Site before each construction activity that requires coordination with other construction, or as specifically called-for in the Specifications.

B. Meeting Attendees: Contractor, Engineer, the Installer and representatives of manufacturers and fabricators involved in or affected by the particular installation or Work activity, and its coordination or integration with other materials and installations that have preceded or will follow.

C. Basic Agenda: Review the progress of other construction activities and preparations for the particular activity under consideration at each Pre-Installation Meeting, including requirements for:

1. Contract Documents.
2. Options.
3. Related Change Orders.
4. Purchases
5. Deliveries.

6. Shop Drawings, Product Data and quality control Samples.
7. Possible conflicts.
8. Compatibility problems.
9. Time schedules.
10. Weather limitations.
11. Manufacturer's recommendations.
12. Compatibility of materials.
13. Acceptability of substrates.
14. Temporary facilities.
15. Space and access limitations.
16. Governing regulations.
17. Safety.
18. Inspection and testing requirements.
19. Required performance results.
20. Recording requirements.
21. Protection.

D. Record significant discussions and agreements and disagreements of each meeting, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including Owner and Engineer.

E. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the meeting at the earliest feasible date.

1.5 PROGRESS MEETINGS

A. Progress meetings shall be conducted at the Project Site on the following recurring schedule:

1. Weekly basis.

B. Meeting Attendees: In addition to representatives of Contractor and Engineer, each Subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at Progress Meetings by persons familiar with the Work and authorized to conclude matters relating to progress.

C. Basic Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed by the Contract Time.

2. With each weekly schedule update, include anticipated testing requirements for the following week, based on anticipated construction activities.

3. Review the present and future needs of each entity present, including:

    a. Interface requirements

    b. Time

    c. Sequences

    d. Deliveries

    e. Off-site fabrication problems

    f. Access

    g. Site utilization

    h. Temporary facilities and services

    i. Hours of Work

    j. Hazards and risks

    k. Housekeeping

    l. Quality and Work standards

    m. Submittals

    n. Change Orders

    o. Documentation of information for payment requests

D. Report of Meeting: After each progress meeting, distribute copies of minutes of the meeting to Owner and Engineer. Contractor shall distribute minutes to others affected by decisions or actions resulting from each meeting or to those parties who should have been present. Contractor shall provide Engineer for inclusion in the report a brief summary, in written narrative form, of progress since the previous meeting.

    1. Schedule Updating: The construction schedule shall be revised after each progress meeting where revisions to the schedule have been made or recognized and the revised schedule shall be issued concurrently with the report of each meeting.

1.6 COORDINATION MEETINGS

A. Project Coordination Meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings. Conduct Coordination Meetings at the Project Site as required.

B. The times and dates of Coordination Meetings will be established by Contractor and Engineer, when each deems necessary to coordinate for progress of the work.

C. Meeting Attendees: Contractor, Engineer and other entities involved in coordination, planning, or execution of the construction activities involved.

D. Record meeting results and distributes copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.7 HEALTH AND SAFETY MEETINGS

A. Contractor is responsible for the health and safety of all Contractor and Subcontractor workers during progress of the work.

B. Contractor shall conduct daily “safety” meetings on-site to address health and safety issues related to the Project.

C. Comply with applicable construction health and safety laws, regulations and other requirements.

1.8 PROJECT CLOSEOUT CONFERENCE:

A. Schedule and conduct a project closeout conference, at a time convenient to Owner and Engineer, but no later than 60 working days prior to the scheduled date of Substantial Completion.

B. Conduct the conference to review requirements and responsibilities related to Project closeout.

1. Attendees: Authorized representatives of Owner, [Owner’s Commissioning Authority,] [Construction Manager,] Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect or delay project closeout, including the following:

1. Preparation of record documents.

2. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.

3. Submittal of written warranties.

4. Requirements for completing sustainable design documentation.

5. Requirements for preparing operations and maintenance data.

6. Requirements for delivery of material samples, attic stock, and spare parts.

7. Requirements for demonstration and training.
8. Preparation of Contractor's punch list.
9. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
10. Closeout Submittals.
11. Warranties.
12. Coordination of separate contracts close-out.
13. Owner's partial occupancy requirements.
14. Installation of Owner's fixtures and equipment.
15. Responsibility for removing temporary facilities and controls.

D. Minutes: Entity conducting meeting will record and distribute meeting minutes.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 3120

QUALITY CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Quality assurance and control of installation
2. References
3. Field samples
4. Mock up
5. Inspection and testing laboratory services
6. Manufacturers' field services and reports.

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

A. Reference to any technical society, organization, group or regulation are made in accordance with applicable designation and unless otherwise noted or specified, all work shall conform to the latest edition as applicable.

B. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Laboratory: An entity engaged to perform specific laboratory tests.

I. Testing Agency: An entity engaged to collect samples, perform specific in-field tests, and/or inspections. The Testing Laboratory may provide the services of the Testing Agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

K. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

L. Experienced: When used with an entity or individual, “experienced” means having successfully completed the minimum number and type of projects indicated in individual Specification Sections, or in the absence of such specified minimum number and type, a minimum of ten (10) years in the execution of projects that are similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of all authorities having jurisdiction.

1.4 SUBMITTALS

A. Contractor’s Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor’s quality-control personnel.

C. Contractor’s Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

D. Testing Agency Qualifications: For testing agencies specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.

2. Entity responsible for performing tests and inspections.

3. Description of test and inspection.

4. Identification of applicable standards.

5. Identification of test and inspection methods.

6. Number of tests and inspections required.

7. Time schedule or time span for tests and inspections.

8. Requirements for obtaining samples.

9. Unique characteristics of each quality-control service.

1.5 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five (5) days prior to the preconstruction conference. Submit in format acceptable to Engineer. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project. Project quality-control manager, who may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.

2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."

3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Engineer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representatives making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.

2. Statement that equipment complies with requirements.

3. Results of operational and other tests and a statement of whether observed performance complies with requirements.

4. Statement whether conditions, products, and installation will affect warranty.

5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. 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 this Section.

C. Monitor quality control over suppliers, manufacturers, products, services, site conditions and workmanship, to produce Work of specified quality.

D. Comply fully with manufacturers' instructions, including each step in sequence.

E. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

F. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes or specified requirements indicate higher standards or more precise workmanship.

G. Perform work by persons qualified to produce workmanship of specified quality.

H. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

I. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

J. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

K. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

L. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

M. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

N. Testing Laboratory and Testing Agency Qualifications: An independent agency with the experience and capability to conduct inspection, sampling, testing, and analysis required, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

O. Preconstruction Testing: Where Testing Agency or Testing Laboratory is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.

b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.

e. When testing is complete, remove test specimens, assemblies, and mockups,; do not reuse products on Project.

2. Testing Agency /Testing Laboratory Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Engineer, with copy to Owner. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

P. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Engineer.

2. Notify Engineer seven (7) working days in advance of dates and times when mockups will be constructed.

3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.

4. Demonstrate the proposed range of aesthetic effects and workmanship.

5. Obtain Engineer's approval of mockups before starting work, fabrication, or construction.

   a. Allow seven (7) working days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

7. Demolish and remove mockups when directed unless otherwise indicated.

1.8 QUALITY CONTROL

A. Sampling, Testing, and Inspection

1. Reports will be submitted by the independent firm to Engineer, Owner, Construction Manager, affected Engineers and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

2. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm as required and/or on instructions by Engineer. Payment for retesting will be charged to Contractor by deducting inspection or testing charges from the Contract Sum/Price.

3. Testing by Owner, Discretionary Testing

   a. Engineer reserves the right to perform any material testing or in-field testing on the project, reserves the right to determine the suitability of all materials to be used for in the work, and to reject any material or completed construction that is not in conformance with applicable Specifications or standards.

4. Contractor Responsibilities: Where quality-control services are indicated as Contractor's responsibility, retain the services of a third-party Testing Agency and Testing Laboratory to perform sampling, testing, monitoring, or inspection as required. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

   a. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

   b. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

   c. Notify Testing Agency at least 24 hours in advance of time when Work that requires sampling, testing, monitoring, or inspecting will be performed.

d. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

e. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

f. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

C. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

D. Re-testing/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.

2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

4. Facilities for storage and field curing of test samples.

5. Delivery of samples to testing agencies.

6. Preliminary design mix proposed for use for material mixes that require control by testing agency.

7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 FIELD SAMPLES

A. Install field samples at the site as required by individual specifications Sections for review.

B. Acceptable samples represent a quality level for the Work.

C. Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by Engineer.

1.10 MOCK-UP

A. Assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals and finishes.

B. Where mock up is specified in individual Sections to be removed, clear area after mock-up has been accepted by Engineer.

1.11 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment and test, adjust and balance of equipment as applicable and to initiate instructions when necessary.

B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.

2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Engineer.

4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 3216

CONSTRUCTION SCHEDULE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Preparation of a Construction Schedule.

2. Updates/revisions to the Construction Schedule throughout the duration of the Work.

B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

1.2 DEFINITIONS

A. Activity: The smallest amount of Work or a single type of Work completed in one specific area of the project defined in the Construction Schedule. Non-Work Activities are included in a schedule when they significantly constrain production activities.

B. Baseline Schedule: A schedule that has been agreed upon by all parties to be the basis upon which to calculate time and earnings progress. The originally-approved Construction Schedule is the first baseline schedule. New baselines will be established following agreements of cost and time as included in construction contract modifications.

C. Construction Schedule: A method of planning and scheduling the Work of the project utilizing a horizontal bar chart format with a separate bar for each Activity with appropriate date/timing data that is an effective tool for planning and monitoring the progress of the Work.

D. Critical Path: That set of activities from the start of the Work through to the end of the Work, that have the minimum Total Float. This Total Float is a shared property of all activities on the Critical Path.

E. Free Float: The amount of time that a schedule activity can be delayed without delaying the early start date of any immediately following schedule activities.

F. Milestone: A key event, deliverable, and/or date that will have the greatest impact on the schedule.

G. Slippage: The time a project or project activity is late compared to the initial Baseline Schedule as the variation between the planned dates of a project starting and finishing or a project activity starting and finishing.

H. Total Float: The total amount of time that a schedule activity may be delayed from its early start without delaying the project finish date, or violating a schedule constraint.

1.3 CONSTRUCTION SCHEDULE FORMAT

A. Format: Utilize a horizontal bar chart (Gantt format) with a separate bar for each Activity with appropriate date/timing data. Clearly label each Activity and corresponding date/timing data.

B. Scale and Spacing: Provide space for notations and revisions.

C. Sheet Size: Minimum sheet size 11 inches by 17 inches. Provide both print and electronic (Portable Document Format; .pdf) versions of the Construction Schedule.

D. Sequence of Listings: The chronological order of the start of each Activity.

1.4 CONSTRUCTION SCHEDULE CONTENT

A. Show complete sequence of construction by Activity, with dates of project start and project completion and dates of start and completion of each Activity. The Critical Path with Baseline must be indicated.

B. Depict Milestones associated with each Activity.

C. Show accumulated percentages of completion of each Activity, and total percentage of Work completed, as of the first day of each month.

1.5 SUBMITTALS

A. Construction Schedule.

1. Submit an initial Construction Schedule within 5 days after date of Notice of Award. After review, resubmit revised Construction Schedule, as required, within 3 days.

2. Submit revised/updated Construction Schedule to Owner and Engineer weekly.

3. Submit one (1) revised/updated Construction Schedule with each Application for Payment.

4. Provide sufficient paper copies of updated Construction Schedule for all attendees at periodic construction meetings, and other project meetings as required. Provide additional copies for periodic distribution as required.

1.6 QUALITY ASSURANCE

A. Utilize skilled personnel with experience in construction scheduling and reporting techniques.

1.7 REVISIONS

A. Indicate progress of each Activity and projected completion date of each Activity.

B. Identify Activities modified since previous schedule, major changes in scope, Slippage, and other identifiable changes.

C. Provide narrative report to define problem areas, anticipated delays, and impact on schedule.

D. Report corrective action taken, or proposed, and its effect.

1.8 DISTRIBUTION

A. Distribute copies of the Construction Schedule to Owner, Engineer Subcontractors, suppliers, and other concerned parties as appropriate.

B. Instruct recipients to promptly report, in writing, problem anticipated by projections indicated in schedules.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Requirements and procedures for preparing and transmitting data to Engineer.

2. Various submittals are specified under applicable Specification Sections.

B. Unless otherwise stipulated herein, all submittals requiring review for conformance with the design documents shall be transmitted by mail to the following address:

BSC Group
300 Winding Brook Drive
Glastonbury, CT 06033
Phone: 860-652-8227
Attention: Jesse Harris, PLA

or by or electronic mail to the following address:

jharris@bscgroup.com

1.2 DEFINITIONS

A. Conforms: The term "Conforms," when applied by the Engineer to the Contractor's submittals, drawings or documents, shall mean the submittals, drawings or documents are satisfactory from the standpoint that the Engineer has not observed any statement or feature that appears to deviate from the Specifications requirements. The Contractor shall retain the entire responsibility for complete conformance with all of the Specification's requirements.

B. Conforms As Noted: The term "Conforms As Noted" when applied by the Engineer to the Contractor's submittals, drawings or documents, shall mean the submittals, drawings or documents conform as defined above, except that the changes shown are necessary to be in conformance with the Specification's requirements. On the basis that the Contractor shall retain the entire responsibility for compliance with all of the Specification's requirements, the Contractor shall either:

1. Incorporate the changes into its work, drawings or documents if the change does not affect the Contractor's responsibility under warranty.

2. Inform the Engineer that the changes cannot be made without prejudice to the Contractor's responsibility under the warranty and resubmit with explanations of the reasons therefore.

C. Does Not Conform or Revise and Resubmit: The terms "Does Not Conform" or "Revise and Resubmit" when applied by Engineer to Contractor's submittals, drawings or documents, shall mean the submittals, drawings or documents are not satisfactory from the standpoint that the Engineer has observed statements or features that appear to deviate from the Specifications requirements.

1.3 CONTRACTOR RESPONSIBILITIES

A. Prepare submittals and review for accuracy prior to submission, and respond to Engineer's action.

B. Determine and verify:

1. Field measurements;

2. Field construction criteria; and

3. Conformance to Specifications.

C. Coordinate each submittal with requirements of Work and of Contract Documents.

D. Notify Engineer in writing, at time of submission, of any deviations in submittals from requirements of drawings, Specifications and Contract Documents.

1.4 SUBMITTAL PROCEDURES

A. Coordinate preparation and processing of submittals with performance of construction activities. Unless a specific submittal time-frame is specified in the related specification Section, transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with phases of the Work that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

3. At a minimum, submittals shall be provided to Owner and Engineer in duplicate. Additional requirements for the number of submittals are contained in the specific Specification Sections.

4. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for re-submittals.

a. Allow five (5) working days for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.

b. Any submittals which may require review and/or approval by an outside Agency (City, Town, utility, etc.) shall be allocated a minimum of twenty (20) working days. The Owner shall not be held responsible for any delay associated with the approval or rejection of any substitution or other revisions proposed by the Contractor.

c. If an intermediate submittal is necessary, process the same as the initial submittal.

d. Allow five (5) working days for reprocessing each submittal.

e. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

B. Submittal Preparation: Place a permanent label, cover page or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label, cover page or title block.

1. Provide a space approximately 4″ x 5″ on the label, cover page or beside the title block to record the Contractor's review and approval markings and the action taken.

2. Include the following information on the label for processing and recording action taken:

a. Submittal name, number and topic.

b. Date of submission.

c. Name and address of Contractor.

d. Number and title of appropriate Specification Section annotated in accordance with this Section.

e. Drawing number and detail references, as appropriate.

f. Identification of revisions on re-submittals.

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than Contractor will be returned without action.

1. All submittals shall be sent with an official transmittal.

2. With each submittal, provide the Specification Section or sheet number the item submitted is found under and a descriptive generic name based on its content.

3. Number each transmittal consecutively starting with 001. If requested by Engineer, match the submittal numbering indicated on the Submittal Schedule or Submittal Log.

4. All submittals shall be numbered conforming to the following example, with each component separated by a dash (-):

Submittal Numbering Format

A	B	C	D
001	01 5713	Silt Fence	New
002	31 2310	Granular Fill	New
002A	31 2310	Granular Fill	Resubmitted
002B	31 2310	Granular Fill	Additional Information

a. The chronological identification number assigned to the submittal package.

b. The Specification Section or sheet number the item submitted is found under.

c. Keyword(s) from the descriptive generic submittal name.

d. The status of the submittal.

Example

001-01 5713-Silt Fence-New

5. When re-submitting a rejected submittal or additional information, identify submittal with the original submittal number followed by a letter, starting with "A" and continuing for each subsequent re-submittal, to designate the additional submission(s).

6. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

7. Distribution: Following response to the initial submittal, Contractor shall print and distribute copies to the Subcontractors and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.

8. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

1.5 SUBMITTAL SCHEDULE

A. As part of the development and acceptance of Contractor's construction schedule, prepare a schedule of submittals, complete and accurate to the best of Contractor's ability. Submit the schedule to the Engineer within five (5) business days following Contractor's receipt of the Notice of Award.

B. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.

C. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted and verify that each item, and the submittal for it, conforms in all respects with the requirements of the Contract Documents. By affixing his signature to each submittal, Contractor is certifying that this coordination has been performed.

D. Coordinate the schedule with all necessary subcontractors to ensure their understanding of the importance of adhering to the approved schedule and their ability to so adhere. Coordinate as required to ensure the grouping of submittals as appropriate.

E. Distribution: Following response to initial submittal schedule, print and distribute copies to the Engineer, Subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

F. Tracking: Provide Engineer, at the beginning of each month, a list of all submittals over the previous month. Include the date each submittal was sent to Engineer, the content of each transmittal and the disposition of the submittal.

1.6 ENGINEER'S ACTION

A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

1. No Exceptions Taken or Conforms: The term "No Exceptions Taken" or "Conforms," when applied by the Engineer to the Contractor's submittals, drawings or documents, shall mean the submittals, drawings or documents are satisfactory from the standpoint that the Engineer has not observed any statement or feature that appears to deviate from the Contract Specifications, Drawings, or other applicable Contract Documents. That part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Specifications, Drawings, or other applicable Contract Documents; final acceptance will depend upon that compliance. Contractor shall retain the entire responsibility for complete conformance with such Contract Specifications, Drawings, or other applicable Contract Documents.

2. Conforms As Noted or Furnish as Corrected: The term "Conforms as Noted" or "Furnish as Corrected" when applied by the Engineer to the Contractor's submittals, drawings or documents, shall mean the submittals, drawings or documents conform as defined above, except that the changes shown are necessary to be in conformance with the Contract Specifications, Drawings, or other applicable Contract Documents. That part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Specifications, Drawings, or other applicable Contract Documents; final acceptance will depend on that compliance. On the basis that, Contractor shall retain the entire responsibility for compliance with all of the Specification's requirements, the Contractor shall either:

a. Incorporate the changes into its work, drawings or documents if the change does not affect the Contractor's responsibility under warranty.

b. Inform the Engineer that the changes cannot be made without prejudice to the Contractor's responsibility under the warranty and resubmit with explanations of the reasons therefore.

3. Does Not Conform or Revise and Resubmit: The terms "Does Not Conform" or "Revise and Resubmit" when applied by Engineer to Contractor's submittals, drawings or documents, shall mean the submittals, drawings or documents are not satisfactory from the standpoint that the Engineer has observed statements or features that appear to deviate from the Contract Specifications, Drawings, or other applicable Contract Documents. Contractor shall not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. In response to this stamp, Contract shall either:

a. Revise the submittal to conform with the Contract Specifications, Drawings, or other applicable Contract Documents and re-submit.

b. Update the submittal with additional information as required and re-submit.

c. Prepare a new submittal in accordance with notations and/or the requirements of the Contract Specifications, Drawings, or other applicable Contract Documents and re-submit.

4. Rejected: The term "Rejected," when applied by Engineer to Contractor's submittals, drawings or documents, shall mean the submittals, drawings or documents are not satisfactory from the standpoint that the Engineer has observed statements or features that appear to deviate from the Contract Specifications, Drawings, or other applicable Contract Documents. Contractor shall not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Submittals that are rejected shall be revised as required to conform with the Contract Specifications, Drawings, or other applicable Contract Documents.

   a. Do not permit submittals marked "Rejected" to be used at the Project site, or elsewhere where Work is in progress.

5. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will not be returned unless specifically requested and will be marked "Action Not Required" on Contractor's record of submittal. Submittals which are prepared but are not required will not be processed.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 5713

TEMPORARY EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Installation of temporary erosion and sedimentation control measures
2. Maintenance of temporary erosion and sedimentation control measures.
3. Monitoring of site condition and installation of supplemental temporary erosion and sedimentation control measures.
4. Sediment removal and disposal
5. Temporary seeding or other surface stabilization measures.
6. Removal of temporary erosion and sedimentation control measures.
7. Monitoring, documentation, and recordkeeping.
8. Installation of permanent erosion control materials.
9. Final cleanup.

B. Erosion and sediment control techniques include, but are in no way limited to, silt fence, hay bales, drainage structure inserts/filters, mulching with hay/straw, netting/matting, grassing, stone dikes/berms/check-dams, compost blankets and berms, barriers, diversions, traps, basins, and appurtenances which will ensure that erosion and sediment pollution will be either eliminated or maintained within acceptable limits.

C. The measures specified herein are the minimum requirements which Contractor shall comply to control erosion and siltation throughout execution of the work. Contractor shall provide additional work if necessary to control erosion and siltation throughout the duration of the construction as conditions dictate, or as directed by Engineer.

D. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

E. Contractor is responsible for all health and safety.

1.2 SUBMITTALS

A. Submit material specifications and shop drawings for all materials furnished under this Section.

B. Prior to the start of the construction, submit schedule for the construction of required stormwater detention basins, temporary and permanent erosion and sedimentation control measures, clearing and grubbing, grading, structures at watercourses, construction, and paving.

C. During construction, submit to Engineer schedule changes that affect timing of construction.

D. Submit copies of all inspection and maintenance report forms.

1.3 REFERENCES

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

B. Regulations of Connecticut State Agencies (RCSA)

1. 22a-315-10 through 19, Soil and Water Conservation

C. Connecticut Department of Energy and Environmental Protection (DEEP)

1. Connecticut Guidelines for Soil Erosion and Sediment Control, DEEP Bulletin 34, State of Connecticut Council on Soil and Water Conservation, 2002.

D. State of Connecticut Department of Transportation (ConnDOT)

1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 817, 2016 and any supplements.

1.4 PERMIT CONDITIONS

A. Contractor and Subcontractors are bound to comply with any project-related permits obtained by Owner or Engineer for the work of the project. Such permits will affect performance of the work, and Contractor and Subcontractors are bound to comply with requirements of such permit and representations contained in permit application as though Contractor and Subcontrator were the Permittee/permit-holder. Requirements and conditions set forth in Owner or Engineer-obtained project-related permits and permit applications shall be binding on Contractor just as any Specification would be.

1.5 QUALITY CONTROL

A. Contractor shall be responsible for the timely installation and maintenance of all sedimentation control devices necessary to prevent the erosion of soil or movement of sediment from construction activities to off-site areas via surface runoff or underground drainage systems. Measures in addition to those shown on the Drawings necessary to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at the expense of Contractor.

B. Where additional erosion and sedimentation control measures are required beyond what is indicated on the Drawings or herein, comply with applicable sections of the Connecticut Guidelines for Soil Erosion and Sediment Control, DEEP Bulletin 34, State of Connecticut Council on Soil and Water Conservation, 2002.

C. If applicable, comply with applicable provisions of the Connecticut Department of Energy and Environmental Protection (DEEP) General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, (DEEP-WPED-GP-015), latest revision thereof. Conditions of such General Permit, other conditions of approval or authorizations, and associated Stormwater Pollution Control Plan (SWPCP) shall become part of the Contract Documents.

D. Engineer has the authority to order immediate, additional, temporary control measures to prevent contamination of adjacent streams or other watercourses, or other areas of water impoundment and damage by erosion.

E. If Engineer observes construction procedures and operations that jeopardize erosion control provisions, Engineer will notify Contractor. If such construction procedures and operations are not corrected promptly, Engineer may suspend the performance of any or all construction until corrections have been made, and such suspension shall not be the basis of any claim by Contractor for additional compensation, nor for an extension of time to complete the Work.

F. Should construction materials be washed away or otherwise rendered ineffective in the opinion of Engineer during the progression of the Work, Contractor shall replace the installations at no additional cost to the Owner.

1.6 COORDINATION WITH PERMANENT EROSION CONTROL PROVISIONS

A. Coordinate temporary erosion and sedimentation control measures with permanent erosion control features to the extent practical to ensure economical, effective and continuous erosion control throughout construction and post-construction periods.

PART 2 PRODUCTS

2.1 HAY BALES

A. Hay bales shall be made of cut hay with forty (40) pounds minimum weight and 120 pounds maximum weight. Bales shall be free of rotten or degraded hay, significant splits or voids. Hay bales shall be held together with a minimum of two bands made of either wire or heavy twine.

B. Stakes to anchor the bales shall be a minimum of 36 inches long and made of hardwood with a minimum dimension of 1½-inch by 1½-inch normal size. Metal stakes may be used instead of wooden stakes. Metal stakes shall be round, “U,” “T,” “L,” or “C” shaped with a minimum weight of 0.5 pounds per foot.

C. Replace individual hay bales upon loss of 30% of original mass or volume, whichever is less.

2.2 SILT FENCE

A. Woven Polypropylene geotextile having a minimum weight of 3.1 ounces per square yard conforming to the following:

1. Mechanical and Physical Properties of Silt Fence Geotextile

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Weight	ASTM D 3776	oz/yd^2	5.6
Grab Tensile Strength	ASTM D 4632	Pounds	60
Grab Elongation (Max percent)	ASTM D 4632	Percent (%)	15–30
Trapezoidal Tear	ASTM D 4533	Pounds	30
Puncture	ASTM D 4833	Pounds	30
Mullen Burst	ASTM D 3786	psi	150–200
Permittivity	ASTM D 4491	Sec^{-1}	0.15

Flow Rate	ASTM D 4491	gal/min/ft2	15–20
Apparent Opening Size	ASTM D 4751	(U.S. Sieve)	30–35
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	70

B. Silt fence shall be constructed of a minimum thirty-six (36) inch wide continuous woven geotextile. The material shall have a high sediment filtration capacity, high slurry flow and minimum clogging characteristics. Edges of the fabric shall be finished to prevent the outer fibers from pulling away from the geotextile. Geotextile shall be free of defects or flaws that significantly affect its physical and/or filtering properties.

C. Fabric shall be securely fastened to stakes a minimum of 42 inches long and made of hardwood with a minimum dimension of 1½ inch by 1½ inch normal size such that a 6 to 8 inch length of fabric is unattached at the bottom for anchorage in soil. Metal stakes may be used instead of wooden stakes. Metal stakes shall be round, "U," "T," "L," or "C" shaped with a minimum weight of 0.5 pounds per foot. Stakes shall be spaced not greater than ten feet apart. When required, wire or another type of support shall be constructed between the geotextile fabric and the posts to improve the load carrying capacity of the silt fence.

2.3 CATCH BASIN INSERT

A. Manufactured "bag type" catch basin insert of woven polypropylene geotextile with integral lifting loops or straps conforming to the following:

1. Mechanical and Physical Properties of Catch Basin Insert

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Grab Tensile Strength	ASTM D 4632	Pounds	315
Grab Elongation (Max percent)	ASTM D 4632	Percent (%)	30 (max)
Trapezoidal Tear	ASTM D 4533	Pounds	40x50 (min)
Puncture	ASTM D 4833	Pounds	135 (min)
Mullen Burst	ASTM D 3786	psi	420 (min)
Permittivity	ASTM D 4491	gal/min/sq ft	0.7
Flow Rate	ASTM D 4491	gal/min/ft2	50 (min)
Apparent Opening Size	ASTM D 4751	(U.S. Sieve)	20-40
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	80 (min)

Note: Catch basin inserts for catch basins with curb openings shall be equipped with integral curb deflector.

2.4 STRAW MULCH

A. Straw mulch shall be comprised of threshold straw of oats, wheat, barely, or rye that is free from noxious weeds, mold or other objectionable material. Straw mulch shall contain at least 50 percent by weight of material to be 10-in or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment. Straw mulch shall be utilized on all newly graded areas with slopes exceeding 5% to protect areas against washouts and erosion unless other erosion control measures are provided.

2.5 FILTER BERM COMPOST

A. Where establishing vegetation is not planned, compost shall be a decomposed, weed free organic matter source derived from agricultural, food, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. Compost shall possess a moisture content of 30 to 60% and a organic matter content of 25 to 100%. The maximum particle length shall be 6″, and 100% passing a 3″, 90 to 100% passing a 1″, 70% to 100% passing a 3/4″, and 30% to 75% passing a 1/4″ screen. However, no more than 50% passing a 1/4″ screen in high rainfall/flow rate situations.

B. Where establishing vegetation is planned, compost shall be use a well decomposed, stable, weed free organic matter source derived from agricultural, food, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. Compost shall possess a moisture content of 30 to 60%, a pH of 6.0 to 8.5 and an organic matter content of 25 to 65%. The maximum particle length shall be 6″, and 100% passing a 3″, 90 to 100% passing a 1″, 70% to 100% passing a 3/4″, and 30% to 75% passing a 1/4″ screen. However, no more than 60% passing a 1/4″ in high rainfall/flow rate situations. It shall contain no substances toxic to plants, shall possess no objectionable odors, and shall not resemble the raw material from which it was derived.

2.6 COMPOST SOIL BLANKET

A. Compost soil blankets may be utilized on slopes of up to 2:1.

B. Slightly scarify slopes and remove large clods, rocks, stumps, roots larger than 2 inches in diameter and debris on slopes, where vegetation is to be established. This soil preparation step may be eliminated where approved by the Landscape Architect/Designer, or where seeding or planting isn't planned. Track (compact) slope using a bulldozer before applying compost.

C. Apply compost at the following rates:

Compost Application Rates

Annual Rainfall/Flow Rate	Total Precipitation & Rainfall Erosivity Index	Application Rate for Slopes to be Vegetated (Note 1)	Application Rate for Slopes not being Unvegetated
Low	1″–25″ & 20–90	½″–¾ ″	1″–1½″
Average	26″–50″ & 91–200	¾″–1″	1½″–2″
High	51″ and above, & 201 and above	1″–2″	2″–4″

D. Lower application rates indicated for slopes to be vegetated should only be used in conjunction with seeding, and for compost blankets applied during the prescribed planting season for the particular region.

E. Compost shall be uniformly applied using an approved spreader unit, including bulldozers, side discharge manure spreaders, etc. Track (compact) the compost layer using a bulldozer or other appropriate equipment. (This step may be eliminated where impractical or where deemed unnecessary by the Landscape Architect/Designer.) Alternatively, apply compost using a pneumatic (blower) unit, or other unit that propels the product directly at the soil surface, thereby preventing water from moving between the soil-compost interface. Thorough watering

may be used to improve settling of the compost. Apply compost layer approximately 3 feet (90 cm) over the top of the slope, or overlap it into existing vegetation.

F. On highly unstable soils, use compost in conjunction with appropriate structural measures.

G. Dry or hydraulic seeding may be completed following compost application, as required, or during the compost application itself, where a pneumatic unit is used to apply the compost.

2.7 STONE CHECK DAM

A. Stone shall be graded as follows:

Gradation of Stone for Check Dam (ConnDOT M.01.01 Grading No. 3)

Sieve	Percent Passing by Weight
2 1/2″	100
2″	90–100
1 1/2″	35–70
1	0–15
1/2″	0–5

Stone shall be sound, tough, durable, angular, not subject to disintegration, on exposure to water, or weathering, be chemically stable and shall be suitable in all other respects for the purpose intended.

B. Geotextile may be used under the stone to provide a stable foundation and to facilitate removal of the stone.

2.8 EROSION CONTROL SEED MIXTURE

Erosion Control Seed

Species (Note 1)	Application Rate, Pounds Per Acre	Application rate, Pounds Per 1,000 sf	Optimum Seed Depth, inches (Note 2)	Optimum Seeding Dates (Note 3)
Annual ryegrass Lolium multiflorum	40	1.00	0.5	3/1–6/15 and 8/1–10/15
Perennial ryegrass Lolium perenne	40	1.00	0.5	3/15–7/1 and 8/1–10/15
Winter Rye Secale cereale	120	3.00	1.00	4/5–7/1 and 8/15–10/15
Oats Avena sativa	86	2	1	3/1–6/15 and 8/1–9/15
Winter Wheat Triticum aestivum	120	3	1	4/15–7/1 and 8/15–10/15
Millet Echinochloa crusgalli	20	.5	1	5/15–7/15
Sudangrass Sorghum sudanese	30	.7	1	5/15–8/1
Buckwheat Fagopyrum esculentum	15	.4	1	4/1–9/15

Weeping lovegrass Eragostis curbula	5	.2	.25	6/1–7/1
ConnDOT All Purpose Mix	150	3.4	.5	3/1–6/15 and 8/1–10/15

Notes:

1 – Listed species may be used in combinations to obtain a broader time spectrum. If used in combinations, reduce each species planting rate by 20% of that listed

2 – Seed at twice the indicated depth for sandy soils.

3 – May be planted throughout summer if soil moisture is adequate or can be irrigated. Fall seeding may be extended 15 days in the coastal towns

2.9 EROSION CONTROL MATTING

A. Temporary Erosion Control Blanket shall be 1) Curlex® Excelsior Blanket, as manufactured by American Excelsior Company, 2) ERO-MAT® V75S(FD), as manufactured by Verdyol Plant Research, Ltd., or 3) Landlok® S2 RD, as manufactured by SI® Geosolutions, or 4) approved equal.

B. Degradable Erosion Control Fabric Netting shall be Landlok® 407 GR, as manufactured by 1) SI® Geosolutions, or 2) GeoJute® as manufactured by Belton Industries, Inc., or 3) BioNet® S150BN™ Double Net Straw Blanket, as manufactured by North American Green, or 4) approved equal.

C. Long-Term and Non-degradable Turf Reinforcement Mats shall be 1) Pyramat®, as manufactured by SI® Geosolutions, or 2) Recyclex® Turf Reinforcement Matting, as manufactured by American Excelsior Company, or 3) Vmax3 C350™, as manufactured by North American Green, or 4) approved equal.

D. Erosion control matting shall be secured with staples or an alternative attachment device such as geotextile pins or plastic pegs as recommended by the manufacturer. The Contractor shall submit a sample of the alternative attachment device for the Engineer's approval prior to installation.

PART 3 EXECUTION

3.1 GENERAL

A. Install erosion and sedimentation control measures as shown on the Drawings prior to any site disturbance.

B. No work shall be started until erosion control schedules and installation have been accepted by Engineer.

C. Engineer has the authority to control the surface area of each material exposed by construction operations and to direct Contractor to immediately provide permanent or temporary pollution control measures to prevent contamination of adjacent watercourses or other areas of water impoundment. Every effort shall be made by Contractor to prevent erosion on the site and abutting properties or areas.

D. Contractor shall construct all permanent erosion and sediment control features at the earliest practical time as outlined in the accepted schedule. Temporary erosion and sediment control measures shall be used to correct conditions that develop during construction, which were unforeseen, but are needed prior to installation of permanent control features, or that are needed temporarily to control erosion or sedimentation which develops during construction operations.

E. Contractor shall limit as necessary the surface area of the earth material exposed to sufficiently maintain and protect the slopes to prevent pollution. Where erosion is likely to be a problem, clearing and grubbing operations shall be scheduled and performed so that grading operations and permanent erosion and sediment control features can follow immediately thereafter, if conditions permit; otherwise, temporary control measures will be required between successive construction stages.

F. Erosion control measures shall be maintained by Contractor, and he shall remove such installations only upon completion of the work and the site is stabilized or when authorized to do so by Engineer.

G. Contractor shall operate all equipment and perform all construction operations so as to minimize pollution. Contractor shall cease any of his operations, which will increase pollution during rainstorms.

H. Failure by Contractor to control erosion, pollution, and siltation shall be cause for the Engineer to employ outside assistance to provide the necessary corrective measures. The cost of such assistance, including engineering costs, will be charged to Contractor and appropriate deductions made to Contractor's payment.

3.2 HAY BALES

A. Hay bales shall be positioned as indicated on the Drawings and/or as necessary to prevent off site movement of sediment produced by, or as a result of, construction activities, or as direct by the Engineer.

B. Hay bales shall be utilized on all catch basins and drainage facilities on the Project Site to prevent the entry of sediments or other debris. Maintain such protection throughout execution of the work until such drainage facilities have been abandoned/removed.

C. Bales shall be placed lengthwise with ends of adjacent bales tightly abutting one another to form a continuous barrier. Bales shall be entrenched to a depth of 4 inches and backfilled, with the backfill placed toward the potential source of runoff and sediment. All bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms. Each bale shall be anchored with a minimum of two stakes, driving the first stake in each bale towards the previously laid bale to drive the bales together. Stakes must be driven a minimum of 18 inches into the ground. Loose hay shall be inserted between bales as required to prevent water from escaping between the bales.

3.3 GEOTEXTILE SILT FENCE

A. Install a filter fabric silt fence prior to construction and remove after full surface restoration has been achieved. Install silt fence as indicated on the Drawings and/or as necessary to prevent off site movement of sediment produced by, or as a result of, construction activities.

B. Install as follows:

1. Hand shovel excavate a small trench a minimum of six inches wide by six inches deep on the upslope side of the desired fence line location.

2. Unroll the siltation fence system, position the post in the back of the trench (downhill side), and hammer the post at least 12 inches into the original ground.

3. Fabric rolls shall be spliced at posts. The fabric shall be overlapped six inches, folded over and securely fastened to posts.

4. Lay the bottom 6 inches of the fabric into the trench to prevent undermining by storm water run-off.

5. Backfill the trench and compact. Compaction is necessary to prevent the run-off from eroding the backfill.

6. For slope and swale installations, extend the ends of the trench sufficiently up slope such that the bottom end of the fence will be higher than the top of the lowest portion of the fence.

3.4 CATCH BASIN INLET SEDIMENT CONTROL

A. Install catch basin inlet sediment control devices in each exiting catch basin as long as it remains in use in accordance with manufacturer's guidelines at the locations shown on the Drawings.

B. A catch basin sediment filter shall be installed and changed/cleaned per the manufacturer's recommendations, or as directed by Engineer during construction.

C. New catch basins shall have a filter installed immediately upon completion of construction. In addition, a hay bale, or similar, barrier shall be installed around the new basin and maintained in place until binder is placed or disturbed areas draining to it are stabilized.

D. Catch basins with curb openings shall have filter fabric covering the opening and the edges of the fabric shall be secured. A filter boom shall also be placed over the opening.

3.5 TEMPORARY SEDIMENT BASINS

A. Temporary sedimentation basins shall be employed as required during construction. Sedimentation shall be periodically removed from the basins and from behind erosion and sedimentation control devices. The Contractor shall direct all possible site runoff to the temporary sedimentation basins.

B. The temporary sedimentation basins shall be maintained from the start of construction until construction of the permanent detention basins is completed and perimeter areas are stabilized.

3.6 TEMPORARY MULCHING

A. Apply temporary mulch to areas where rough grading has been completed but final grading is not anticipated to begin within 30 calendar days of the completion of rough grading or where final grading has been completed but seeding is not anticipated for 20 days.

1. Straw/Hay Mulch

   Exposure Period: 6 months

Application Method: By hand or machine

Application Rate: 110 lbs/1,000 square feet.

2. Bark Chips/Shredded Bark

Exposure Period: Less than one year

Application Method: By hand or machine

Application Rate: 6 cubic yards /1,000 square feet.

3.7 TEMPORARY EROSION CONTROL MATS

A. Erosion control mats shall be furnished, installed, maintained, and later removed in ditches or swales, on embankment slopes, and excavation slopes at the locations shown on the Drawings in accordance with the manufacturer's recommendations.

B. All areas shall be smooth graded and compacted. Remove all rocks, dirt clods, vegetation and other obstructions that may cause damage to the mats.

C. Unroll mats parallel to the direction of water flow and lay flat against the ground. Overlap roll ends 1–2 feet with upslope mat on the top to prevent uplift of mat end by water flow. Overlay adjacent edges of mat by six inches. Extend mat 2–3 feet above the crest of steep slopes and anchor by excavating a 6-inch-deep trench, and secure end of mat in trench, backfill and compact. Secure mat to the ground using staples or pins furnished by manufacturer of mat.

D. When no longer required, as determined by the Engineer, temporary erosion control mats shall become the property of the Contractor and be removed and properly disposed.

E. Ground disturbances, including holes and depressions caused by the installation and removal of the temporary erosion control blanket shall be backfilled and repaired.

3.8 INSPECTIONS AND MAINTENANCE

A. Contractor is responsible to maintain the sediment and erosion control features at all times throughout the project duration and until the completion certification and approval has been issued.

B. Regular erosion and sediment control system inspections shall be conducted by Contractor throughout the project duration. At a minimum, Contractor shall conduct daily inspections and maintain erosion control systems in good operating condition. Report the results of the inspection and the recommended maintenance and/or repair requirements to Engineer.

C. Additional inspections may be required and/or directed prior to, or immediately following, a storm event >0.1 inches. Repairs shall be made as necessary.

D. In the event that the sedimentation and erosion control measures employed by Contractor prove to be inadequate as determined by the Engineer, Contractor shall adjust operations to the extent necessary to prevent erosion and sediment transport.

E. Surface water shall be pumped to maintain excavations free of water. Comply with applicable requirements of the Connecticut Department of Environmental Protection, specifically those

requirements related to the management of stormwater and dewatering wastewaters associated with construction activities.

F. Hay bales and/or silt fences.

1. Remove accumulated sediment once it builds up to one-half of the height of the bale or fabric.

2. Replace damaged or degraded bales as necessary or when directed by the Engineer.

3. Replace damaged fabric, or patch with a 2-ft minimum overlap. Overlaps may only be made at fence posts.

4. Make other repairs as necessary to ensure that the bales/fence is filtering all runoff.

G. Erosion Control Mats shall be inspected at least once a week. Areas where the mat has become dislodged from the soil surface or become torn shall be re-graded and re-seeded as necessary and the mat re-installed. When repetitive failures occur at the same location review conditions and modify erosion control measures to reduce failure rate. Temporary erosion control blanket damaged during the progress of work or resulting from the Contractor's vehicles, equipment, or operations shall be repaired or replaced at the expense of the Contractor.

H. Clean catch basin inlet sediment control devices in accordance with manufacturer's guidelines.

I. Any catch basins that collect sediment as a result of Contractor's work shall be thoroughly cleaned out by Contractor.

END OF SECTION

SECTION 01 5714

TEMPORARY DUST CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnishing and spreading water, calcium chloride, and/or mulch on the subgrade, or in other areas of a Project Site or associated off-site areas, for the purpose of controlling dust emissions.

B. The requirements set forth in this section of the specifications apply to all phases and areas of construction.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. Regulations of Connecticut State Agencies (RCSA)

1. RCSA Section 22a-174-1 through 43, Abatement of Air Pollution.

C. ASTM International (ASTM)

1. ASTM D98, Standard Specification for Calcium Chloride.

PART 2 PRODUCTS

2.1 MATERIALS

A. Only water, calcium chloride, and mulch are approved for dust control. No asphalt or petroleum-based products may be utilized for dust control.

B. Water used shall be clean, non-polluted water obtained from sources approved by Engineer.

C. Calcium chloride, ASTM D98. Calcium chloride in pellet form and flake form shall be acceptable.

1. Calcium chloride shall be packaged in moisture proof bags or in airtight drums with the manufacturer, name of product, net weight, and percentage of calcium chloride guaranteed by the manufacturer legibly marked on each container.

2. Engineer may reject calcium chloride failing to meet the requirements of the aforementioned specifications or which has become caked or sticky in shipment.

D. Mulch

1. Straw mulch: Threshold straw of oats, wheat, barely, or rye that is free from noxious weeds, mold or other objectionable material. Straw mulch shall contain at least 50 percent by weight of material to be 10-in or longer.

2. Wood chips: Processed tree trimmings free of trash or other physical contaminants such as metal and plastic.

PART 3 EXECUTION

3.1 GENERAL

A. Dust control shall be the responsibility of Contractor and dust control operations shall meet the requirements of the State of Connecticut Department of Environmental Protection.

B. Construction sequencing shall be organized and conducted in a manner to leave existing pavement or ground coverings in place until just prior to earth excavation for the purpose of minimizing the migration of dust beyond the Project Limits into the surrounding area.

C. Engineer reserves the right to conduct active dust monitoring using visual methods and may utilize particulate measurement equipment during the course of the work. If the amount of fugitive dust and/or particulate generated during the work is deemed unacceptable in the Engineer's judgment or exceeds baseline Project Site conditions at Engineer's monitoring locations, Engineer may require Contractor to stop work and implement corrective measures. No claim for delay will be considered for work stoppage based upon the results of Engineer's active dust monitoring results.

D. Stockpiled materials from which particle have the potential of becoming airborne shall be securely covered with a temporary waterproof covering made of polyethylene, polypropylene, hypalon, or approved equal. The covers must be in place at all times when work with the stockpiles is not occurring.

E. Subcontractor shall sweep all adjacent roads and neighboring parking lots and driveways that are impacted by the work. Whenever dirt is tracked from the site it shall be cleaned as necessary to prevent it from becoming a nuisance or hazard. At a minimum, adjacent streets shall be swept once per week.

3.2 WATER

A. The application of water shall be under the control of Engineer at all times. It shall be applied only at the locations, and at such times, and in the amount as may be directed by Engineer. Quantities of water wasted or applied without authorization will not be paid for.

B. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding or pollution.

C. Contractor shall have available and maintain in an operable condition at all times, sufficient equipment for the purpose of applying water for dust control.

D. Watering equipment shall consist of pipelines, tanks, tank trucks, distributors, pumps, meters, hose or other devices, approved by Engineer, which are capable of applying a uniform spread of water over the surface. A suitable device for a positive shut-off and for regulating the flow of water shall be located so as to permit positive operator control.

E. Applications of water for dust suppression include, but are not necessarily limited to, the following:

1. Demolition activities, material handling, material processing, and loading.

2. Earthwork.

3. Open excavation faces and dust-prone areas of the work.

4. Temporary access roads and roadway surfaces within and around the Project Site.

3.3 CALCIUM CHLORIDE

A. Calcium chloride shall be applied only at the locations, at such times and in the amount as may be directed by the Engineer and only in areas that will not be adversely affected by the application. Refer to Section 01 3543 – Environmental Protection.

B. Calcium chloride shall be uniformly applied at the rate of one and one-half (1½) pounds per square yard (lb/yd2) or at any other rate as directed by Engineer. Application shall be by means of a mechanical spreader, or other approved methods. The number and frequency of applications shall be to Engineer's satisfaction.

3.4 MULCH FOR DUST CONTROL

A. Coordinate the use of mulch for dust control with erosion and sedimentation control measures.

B. Straw mulch shall be applied at a rate of 100 pounds per 1,000 square feet (100 lb/1,000 ft2).

C. Wood chips or wood mulch shall be applied at such a rate as to form a layer one (1) inch thick.

3.5 OTHER DUST CONTROL MEASURES

A. A temporary seed mixture may be spread in lieu of, or in addition to mulch over areas where the suspension of grading work in disturbed areas is expected to be more than 30 calendar days and as directed by Engineer.

END OF SECTION

SECTION 01 5723

TEMPORARY STORMWATER POLLUTION CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Compliance with the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities (DEEP-WPED-GP-015) (hereinafter "Stormwater General Permit") including the Stormwater Pollution Control Plan (SWPCP).

1.2 PERMIT CONDITIONS

A. Contractor and Subcontractors are bound to comply with permits obtained for the project, whether such permits are obtained by Owner, Engineer, Contractor, or Subcontractor for the work of the project. Such permits will affect performance of the work, and Contractor and Subcontractors are bound to comply with requirements of such permit and representations contained in permit application as though Contractor and Subcontractor were the Permittee, permit-holder, or registrant. Requirements and conditions set forth in Owner or Engineer-obtained project-related permits and permit applications shall be binding on Contractor and Subcontractors just as any Specification would be.

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1. 22a-315-10 through 19, Soil and Water Conservation

C. Connecticut Department of Energy and Environmental Protection (DEEP)

1. General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities (DEEP-WPED-GP-015).

2. Connecticut Guidelines for Soil Erosion and Sediment Control, DEP Bulletin 34, State of Connecticut Council on Soil and Water Conservation, 2002.

1.4 SUBMITTALS

A. General: Contractor shall maintain copies of all permit-related documents at the Project Site and shall make them available during construction, and provide copies to the Engineer.

B. Inspection reports: Provide copies of inspection reports to Owner and applicable Permittee.

C. Additional information as required by the DEEP deemed necessary to evaluate the consistency of the subject activity with the requirements for authorization under the Stormwater General Permit.

D. Documents or correspondences between Contractor and DEEP, local authorities, wetland agencies, etc. including notices of violation, enforcement actions, or proposed fines by regulatory agencies.

E. Notice of Termination forms prescribed and provided by DEEP.

1.5 QUALITY ASSURANCE

A. The conditions of the Stormwater General Permit, the SWPCP, and other conditions of approval or authorizations shall become part of the Contract Documents.

B. Use adequate personnel who are trained and experienced in the necessary protocols and techniques, and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.

C. Use equipment of adequate size, capacity and quantity to accomplish the management of all wastewaters under this Section.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Notify Permittee, Owner, and Engineer immediately upon request from any regulatory agency to enter, inspect, sample, monitor, or otherwise access the project site or Contractor's records pertaining to the General Permit, erosion and sedimentation control, or other water pollution control.

3.2 STORMWATER GENERAL PERMIT

A. Maintain compliance with the Stormwater General Permit at all times.

B. Comply with required provisions of the SWPCP at all times.

C. Cooperate with the Permittee, Owner, and Engineer during all inspections and monitoring. Take corrective action within required time-frames if deficiencies are noted.

D. Contractor shall maintain a rain gauge on the Project Site that meets the requirements of the Stormwater General Permit.

E. All work shall be conducted in compliance with all conditions of the General Permit, SWPCP, and Section 01 5713 – Temporary Erosion and Sedimentation Controls.

3.3 VIOLATIONS

A. Penalties: Contractor shall be responsible for penalties assessed on Contractor or the Owner as a result of Contractor's failure to comply with the requirements of the Stormwater General Permit, SWPCP, or with the applicable provisions of the Federal, State, and local regulations and requirements.

B. Penalties as used in this section shall include fines, penalties, and damages, whether proposed, assessed, or levied against the Contractor or the Owner, by governmental agencies or as a result of citizen suits. Penalties shall also include payments made or costs incurred in settlement for

alleged violations of applicable laws, regulations, or requirements. Costs incurred could include sums spent instead of penalties, in mitigation or to remediate or correct violations.

END OF SECTION

SECTION 01 7113

MOBILIZATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies requirements for general preparation of the Project Site as required for construction operations including:

1. General Mobilization
2. Construction Site Safety
3. Utility Mark-Out
4. Temporary Utilities
5. Temporary Field Office
6. Security
7. Fire Protection

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

C. Contractor shall be responsible for all health and safety.

D. Contractor is solely responsible for obtaining permits or approvals which may be required to perform the work, including all costs, fees and taxes required or levied. Notify and obtain such permits or approvals from all agencies having jurisdiction prior to starting work.

1.2 REFERENCES

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

B. American National Standards Institute (ANSI)

1. ANSI Z535.1 – American National Standard, Safety Colors.

C. Code of Federal Regulations (CFR)

1. 29 CFR 1926, Safety and Health Regulations for Construction.

D. Connecticut State Building Code, including all applicable Amendments and Supplements.

E. State of Connecticut Department of Transportation (ConnDOT)

1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 817, 2016 and any supplements.

1.3 SAFETY REQUIREMENTS

A. As a specialist in its field of work, Contractor accepts complete responsibility for performing its work safely. This includes sole responsibility for the health and safety of its employees, agents, subcontractors (and their employees) and any other person on or adjacent to the work area.

B. Owner or Engineer are not responsible for the monitoring of health and safety. Contractor's responsibility includes compliance with all current laws, codes, ordinances, rules, regulations, standards and requirements of applicable public and private agencies and authorities ("Laws"). Contractor must take all measures and safeguards necessary to protect: (1) employees, (whether or not working for the Contractor), (2) employees and agents of Owner, (3) members of the general public and (4) public and private property.

C. Contractor is an independent contractor, with responsibility for its means and methods and the safety of its workers and Owner is not intended to be and shall not be considered an employer of Contractor's employees. As such, it shall be Contractor's sole duty to monitor the performance and practices of its employees and subcontractors for safety, to ensure that the practices and methods of performing the work are safe and to immediately stop any unsafe practices by its employees or its second or subsequent tier subcontractors ("subcontractors") or their employees. No actions taken by Owner or its consultants to monitor practices or performance of the work for safety or to stop any unsafe practices by Contractor or its subcontractors shall be construed to suggest or imply that Owner or its consultants has or has assumed any obligation or duty to take such actions.

D. Contractor accepts complete responsibility for compliance with safety procedures and policies contained in the Contract Documents and compliance with all applicable Laws, relating to health or safety, including, but not limited to the Occupational Safety and Health Act of 1970, as amended, and the regulations and standards of the Occupational Safety & Health Administration and similar state agencies ("OSHA") ("Health and Safety Laws").

E. All obligations and requirements of Contractor in this document also apply to Contractor's subcontractors. No person or entity performing work for or on behalf of Contractor is excluded from compliance.

1.4 UTILITY MARK-OUT

A. Prior to commencing work, comply with utility mark-out requirements of the Call-Before-You-Dig System (1-800-922-4455).

1. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.

B. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work.

1.5 TEMPORARY UTILITIES

A. Temporary Water

1. All water for construction purposes, as well as the means of having the water conveyed about the work, shall be provided by Contractor and the cost of this work shall be included in the cost of the work to be done under this Contract.

2. The source, quality and quantity of water furnished shall at all times be satisfactory to Engineer.

3. Contractor shall coordinate with Avon Public Schools, Avon Water Company, and/or Connecticut Water Company for temporary water service. Obtain all permits and comply with applicable codes of jurisdictional authorities.

4. Contractor shall pay Avon Public Schools, Avon Water Company, and/or Connecticut Water Company, or other water provider as applicable, all fees for the provision of temporary water service and usage, including but not necessarily limited to those levied for applications, inspections, meters, valves, backflow prevention, other devices, and usage.

5. Comply with Avon Public Schools, Avon Water Company, and/or Connecticut Water Company for temporary water service, including equipment which may be required such as meters, valves, backflow prevention or other devices.

6. Temporary Drinking Water

a. Provide adequate potable drinking water, so piped, transported, and stored so as to keep it safe and fresh, and served from satisfactory types of sanitary drinking stands, fountains, or single service containers.

b. Provide all such facilities and services in strict accordance with applicable health regulations.

B. Temporary Electric Power

1. Contractor shall coordinate with Eversource or other electric provider as applicable for temporary electric service to operate temporary facilities, construction equipment, temporary lighting, weather protection, heating, etc. Obtain all permits and comply with applicable codes of jurisdictional authorities and OSHA.

2. Contractor shall pay Eversource or other electric provider as applicable for provision of temporary power facilities and usage.

3. Contractor shall provide sufficient electric lighting so that all work may be done in a workmanlike manner when there is not sufficient daylight.

4. The use of alternate sources of temporary electric power such as generators shall be utilized only with the approval of Engineer.

C. Temporary Sanitary Facilities

1. Provide and maintain portable facilities and enclosures at the site as required to support the work of this project, and include cleaning, installation and removal to meet all OSHA requirements.

2. Location for temporary sanitary facilities shall be coordinated with the Owner.

D. Other Temporary Services

1. Provide all other temporary services as required to satisfactorily complete the work.

1.6 TEMPORARY FIELD OFFICES

A. A temporary field office is not a requirement of the project.

1. If Contractor elects to utilize a temporary field office, coordinate with Avon High School representatives as required.

2. Contractor shall pay all costs for maintenance of temporary field office throughout the work.

3. Owner assumes no responsibility for security, theft, vandalism, or loss of any kind associated with Contractor's temporary field office.

1.7 SECURITY

A. Prior to the start of any on-site work, provide Town of Avon Police Department a summary of the work to be performed, including Contractor contact personnel and work schedule.

B. Security of work areas must be maintained by Contractor at all times during the work. Contractor shall provide for all security as necessary to control access to the Project Site and protection of Contractor's material and equipment.

C. Owner and Engineer assume no responsibility for equipment, tools or materials stored, staged or otherwise present at the Project Site. Contractor assumes full and complete responsibility for damage, theft or other loss occurring to equipment, tools or materials stored, staged or otherwise present at the Project Site.

1.8 FIRE PROTECTION

A. Comply with all applicable fire protection and prevention requirements which may be established by Federal, State or local governmental agencies. Prior to the start of any on-site work, provide the Town of Avon Volunteer Fire Department a summary of the work to be performed, including Contractor contact personnel and work schedule.

B. Take all precautions necessary to prevent fires. Contractor shall be responsible to ensure that the area within the Project Limits is kept orderly and clean and that combustible rubbish and construction debris is promptly removed from the Project Site.

C. Installation of equipment suitable for fire protection shall be done as soon as possible after commencement of operations.

D. Fuel for cutting and heating torches shall be gas only and shall be contained in UL-approved containers.

E. Provide and maintain fire extinguishers in the immediate vicinity where welding tools or torches of any type are in use. The fire extinguisher shall be a type appropriate for the fire hazards of the work area. Contractor shall provide a fire watch during times of welding or burning near combustible materials.

PART 2 PRODUCTS

2.1 CONSTRUCTION SIGNS

A. Construction Safety Signs: Provide Construction Safety Signs as indicated on the Drawings and as required around the Project Site to provide warning of potential dangers or hazards associated with construction activities. Conform with 29 CFR 1926 and other State or local requirements. Signs shown on the Drawings in no way represent the complete sign package for the Project Site. Contractor shall bear full responsibility for deploying appropriate construction safety signs as may be required.

B. Construction Safety Signs shall include the following types:

1. Danger Signs: Danger signs shall be used only where an immediate hazard exists.

   a. Danger signs shall have red as the predominating color for the upper panel; black outline on the borders; and a white lower panel for additional sign wording.

2. Caution Signs: Caution signs shall be used only to warn against potential hazards or to caution against unsafe practices.

   a. Caution signs shall have yellow as the predominating color; black upper panel and borders; yellow lettering of "caution" on the black panel; and the lower yellow panel for additional sign wording. Black lettering shall be used for additional wording.

   b. Standard color of the background: yellow; panel, black with yellow letters. Any letters used against the yellow background shall be black. Colors: opaque glossy samples, ANSI Z535.1.

3. Exit Signs: Exit signs, when required, shall be lettered in legible red letters, not less than 6 inches high, on a white field and the principal stroke of the letters shall be at least three-fourths inch in width.

4. Safety Instruction Signs: Safety instruction signs, when used, shall be white with green upper panel with white letters to convey the principal message. Any additional wording on the sign shall be black letters on the white background.

5. Directional Signs: Directional signs, other than automotive traffic signs specified in "Traffic Signs" below, shall be white with a black panel and a white directional symbol. Any additional wording on the sign shall be black letters on the white background. Where applicable, directional signs shall conform to the *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).*

6. Traffic Signs: Construction areas shall be posted with legible traffic signs at points of hazard. All traffic control signs or devices used for protection of construction workers shall conform to the *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).*

C. Temporary Sign Mounting

1. Fence Mounted: Heavy duty nylon cable ties, stainless steel wire, or other approved method.

2. Post-mounted: Unless otherwise approved, ConnDOT "Breakaway Type II Installation." Posts shall be steel, 3 pounds/foot Type A or B.

a. Mounting height: 7 ft. Horizontal clearance: Locate post such that no portion of sign is within 2 ft of roadway/travelway edge.

PART 3 EXECUTION

3.1 GENERAL MOBILIZATION

A. Sedimentation and Erosion Control

1. Install sedimentation and erosion controls in accordance with Section 01 5713 – Temporary Erosion and Sedimentation Controls.

B. Construction Entrance

1. Locate stabilized construction entrance(s) (anti-tracking pad) as shown on the Drawings.

2. The stabilized construction entrance shall be installed prior to any site work which involving heavy equipment or any site disturbance which may reasonably be expected to generate soils, mud, or other accumulations which may adhere to vehicles leaving the Project Site.

3. Remove stabilized construction entrance at the completion of the work.

C. Fencing and Barriers

1. Temporary Construction Fencing

a. The temporary construction fencing shown is depicted in general configuration only. Contractor is solely responsible for securing the entire Project Site or area of the Work as necessary for proper control of operations on the Project Site and as required to complete the work in a safe and secure manner whether such fencing is shown on the Drawings or not.

D. Other Barriers and Similar Facilities

1. Provide other safety barriers, including but not limited to, fencing, barricades, and signage as required to prevent unauthorized entry to the Project Site, construction areas or open excavations. Provide barriers which are necessary for proper control of operations on the Project Site and as required to complete the work in a safe and secure manner. Comply at all times with applicable federal, state and local regulations. Adapt barriers and associated protection to evolving site conditions throughout the progress of the work.

E. Other Safety Devices and Work Controls

1. Provide other safety devices, including but not limited to, signs, cones, barrels, lights, warning lights, and sirens as required for safety. Provide those safety devices which are

necessary for proper control of operations on the Project Site and as required to complete the work in a safe and secure manner. Comply at all times with applicable federal, state and local regulations. Adapt safety devices to evolving site conditions throughout the progress of the work.

END OF SECTION

SECTION 01 7123

FIELD ENGINEERING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Surveying.

2. Construction Layout.

3. Recording and documenting the work.

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. State of Connecticut.

1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 817, 2016 and any supplements.

1.3 SUBMITTALS

A. Surveyor: For record purposes, submit name and qualifications of Professional Land Surveyor who will be responsible for surveying and construction layout.

B. For record, copies of appropriate site plans indicating benchmark locations, with horizontal and vertical data.

C. Site survey information in accordance with the appropriate Specification Sections.

D. Survey Logs: On request, submit copies of field documents verifying accuracy of survey work.

E. Certificates: Submit a certificate co-signed by a licensed Land Surveyor or licensed Professional Engineer certifying that the location and elevation of improvements comply with the Contract Documents and any approved changes in the work.

F. As-Built Drawings: For record, submit two prints of the final As-Built drawings to Engineer prior to submittal of Application for Final Payment.

G. Project Record Documents: Submit other pertinent documentation as may be required or appropriate.

1.4 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 this Section.

B. Surveyor: Engage a Land Surveyor licensed as a Professional Land Surveyor (PLS) in the State of Connecticut to perform surveying and construction layout.

1.5 CONSTRUCTION TOLERANCE

A. Contractor shall perform random spot-checks to verify surface tolerances. Any irregularity of the surface exceeding these limits shall be corrected.

B. Bituminous Pavement Base Course: Surface shall not vary more than 3/8 inch from a ten-foot straightedge placed on such surface.

C. Bituminous Pavement Final Surface: Final surface shall not vary more than 1/4 inch from a ten-foot straightedge placed on such surface.

D. Concrete Surfaces: Final surface shall not vary more than 1/4-inch of the indicated elevation or dimension, and shall not deviate more than 1/8-inch from a 10 ten-foot straightedge placed anywhere on the surface.

E. Adjacent Work: Work of the same material where two sections meet shall not vary by more than 1/8-inch.

F. Handicapped Accessibility/ADA: Any elevation or slope that is compliant with construction tolerances indicated in the Contract Documents but exceeds elevation, slope, or other critical regulatory dimension required for compliance with handicapped accessibility per Connecticut Building Code shall be considered deficient.

1.6 PROJECT RECORD DOCUMENTS – SPECIFICATIONS

A. Legibly mark and record at each Product section description of actual Products installed, including the following:

1. Manufacturer’s name, address and telephone number and product model and serial number.

2. Product substitutions or alternates utilized.

3. Changes made by Addenda and Modifications.

4. All information shall be cross referenced to equipment tag numbers.

1.7 WORKING AS-BUILT DRAWINGS

A. Contractor shall revise two (2) sets of paper drawings by red-line process to show the as-built conditions during prosecution of the work. These working as-built marked drawings shall be kept current on a weekly basis and at least one set shall be available on the Project Site at all times. Working as-built drawings shall be accurately and neatly record by means of appropriate

details and notes all changes from the Drawings or Specifications which are made in the work or additional information which might be uncovered in the course of construction as such changes occur.

1.8 FINAL AS-BUILT DRAWINGS:

A. The final as-built drawings shall be based on the working as-built drawings modified as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with working as-built drawings, and adding such additional drawings as may be necessary. Accurately and neatly record by means of appropriate details and notes all changes from the Drawings or Specifications which were made in the work or additional information which was uncovered in the course of construction

B. The final as-built drawings shall be neat, legible and accurate. These drawings are part of the permanent records of this project and shall be prepared to the satisfaction of Engineer. Any drawings damaged or lost by Contractor shall be satisfactorily replaced by Contractor at no expense to Owner.

C. Final as-built drawings are not a substitute for a Final Survey and are in addition to any requirement for a Final Survey as indicated in the Specifications.

D. The working and final as-built drawings shall show, but not necessarily be limited to, the following information:

1. Grade, elevations, cross-section, invert, and alignment of earthwork, structures, utilities, or equipment if any changes were made from the Drawings.

2. Grade, elevations, cross-section, invert, and alignment of any existing earthwork, structures, utilities, or equipment affected as part of the work.

3. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by Contractor; including but not limited to fabrication, erection, installation plans, and placing details, pipe sizes, depths, inverts, etc.

4. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

5. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

6. Field changes of dimension and detail.

7. Detail not on original Contract Drawings.

8. Changes or modifications which result from punch lists or final inspection.

E. Where the Drawings or Specifications present options, only the option selected for construction shall be shown on the final as-built drawings.

F. Modifications: Any Change Order price shall include Contractor’s cost to change working and final as-built drawings to reflect modifications. Modifications shall be noted on the working and final as-built drawings as follows:

1. A Modification Circle (“Cloud Circle”) shall be placed at the location of each deletion.

2. For new details or sections which are added to a Drawing, a Modification Circle shall be placed by the detail or section title.

3. For minor changes, a Modification Circle shall be placed by the area changed on the Drawing (each location).

4. For major changes to a Drawing, a Modification Circle shall be placed by the title of the affected plan, section, or detail at each location.

5. For changes to schedules or Drawings, a Modification Circle shall be placed either by the schedule heading or by the change in the schedule.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Existing Conditions, General: Verify site conditions before proceeding with the work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any hazardous conditions and/or discrepancies.

B. Existing Conditions, Utilities: The existence and location of all utilities, both above-ground and underground as may be indicated on the Drawings are not guaranteed and should be considered approximate as to size and location. Before beginning work, investigate and verify the existence and location of all utilities and associated construction.

1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping. Notify Engineer of any discrepancies prior to proceeding.

C. Where verification indicates that the existing conditions are such that any portion of the work or element to be installed cannot be completed or installed as indicated in the Contract Documents, notify the Engineer prior to performing the work.

D. It shall be the sole responsibility of Contractor to protect all site improvements, utilities, and structures potentially affected by the work.

3.2 BENCHMARKS AND SURVEY MONUMENTS

A. Use survey control points shown on the Drawings, if provided. If not provided, establish control points as required to complete the work.

B. Benchmarks: Establish and maintain a minimum of two (2) benchmarks on the Project Site for the duration of the work, referenced to data established by survey control points.

1. Record benchmark locations, with horizontal and vertical data, on appropriate site plans and provide to Engineer. Include all benchmarks on the working and final as-built drawings.

2. Protect existing benchmarks and control points, and preserve any permanent reference points during performance of the Work.

3. Do not change or relocate existing benchmarks or control points without prior written approval from Engineer.

4. Promptly replace lost or destroyed benchmarks or project control points. Base replacements on original locations.

C. Permanent: Establish four (4) survey monuments on the Project Site at the conclusion of the Work, referenced to data established by survey control points.

1. Locations of permanent survey monuments will be in the general vicinity of the work, however specific locations will be selected by Engineer.

2. Record survey monument locations, with horizontal and vertical data, on appropriate site plans and provide to Engineer.

3.3 LAYOUT

A. Responsibility for Layout of the Work: Contractor is solely responsible for complete, timely and accurate layout of all work, including, but not necessarily limited to, horizontal and vertical control and dimensional coordination as necessary to construct the work in accordance with the Contract Documents.

B. Employ a Connecticut-licensed Land Surveyor to perform survey work.

1. Verify layout information shown on the Drawings, in relation to control points and existing benchmarks before proceeding to layout the work.

2. Site Improvements: Locate and lay-out site improvements by instrumentation and similar appropriate means.

3. Working from lines and levels established for this project, set lines, levels, and other layout markers as needed to properly locate the horizontal and vertical location of each element of the work. Calculate and measure required dimensions and within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.

4. Advise entities engaged in construction activities, of marked lines and levels provided for their use. Utilize recognized engineering survey practices.

C. Existing Utilities: Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in, or affected by construction. Coordinate with Engineer and local authorities having jurisdiction.

3.4 VERIFICATION

A. As construction proceeds, check every major element for line, level and plumb.

B. Surveyor’s Log: maintain a surveyor’s log of control and other survey Work. Make this log available to Engineer for reference.

C. Record deviations from required lines and levels, and advise Owner when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.

D. On completion of foundation and retaining walls, major site improvements, and other Work requiring field engineering services, prepare a certified survey showing dimensions, locations, angles and elevations of construction and site work.

3.5 PERFORMANCE

A. Specific construction methodology shall be the Contractor's sole responsibility including the cost of using engineering services and recommendations as necessary.

B. Inform Engineer of any anticipated or encountered problems in proposed layout of the work and/or construction methodology. Proceed with work only when such problems are fully resolved by Contractor, utilizing such engineering support services as required.

END OF SECTION

SECTION 01 7124

AS-BUILT SURVEY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Final survey of completed construction.

2. Preparation of "As-Built" Drawings.

3. Preparation of "As-Built" Drawings on polyester film for filing with the Town of Avon.

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. State of Connecticut, Regulations of Connecticut State Agencies (RCSA)

1. Sections 20-300b-1 through 20-300b-20, Standards for Surveys and Maps in the State of Connecticut.

1.3 SUBMITTALS

A. Surveyor: Submit name and qualifications of Professional Land Surveyor who will be responsible for the work of this Section.

B. Certificates: Submit a certificate signed by a Connecticut-licensed Land Surveyor certifying that the location and elevation of improvements comply with the Contract Documents and any approved changes in the work.

C. Final Survey: Prepare and submit two (2) copies of the final survey.

D. Survey Data: Survey Data shall include field notes, measurements, survey data files, data points, control points, AutoCAD files, and other survey-related data obtained or generated during the course of surveying work.

E. Project Record Documents: Submit other pertinent documentation as may be required or appropriate.

1.4 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 this Section.

B. Surveyor: Engage a Land Surveyor licensed as a Professional Land Surveyor (PLS) in the State of Connecticut to perform survey work.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 FINAL SURVEY

A. Provide Improvement Location Survey to depict the horizontal and vertical location of all new construction.

3.2 AS-BUILT DRAWINGS

A. Prepare final As-Built Drawings which accurately depict the final configuration of all new construction. Document by means of appropriate details and notes, and all changes from the Drawings or Specifications which were made in the work or additional information which was uncovered in the course of construction.

B. As-Built Drawings shall depict the actual location of all above-grade and below grade construction. Collect sufficient survey data in an ongoing manner to accurately represent the project scope and area.

1. Survey shall include locations of all physical features installed during the construction with appropriate labelling. Subsurface construction shall depict the actual location, depth, and configuration of improvements. Utilities shall include the appropriate notations/labeling for type, size, material of construction and depth. Clearly indicate all appurtenances such as valves, tees, cleanouts, etc. with accurate location data.

2. From established survey control, conduct a topographic survey of the project area after construction is complete. Generate one-foot contours throughout the area of work and show breaks in slope and other notable features.

3. Pedestrian routes shall depict sufficient topographic data to confirm compliance with handicapped accessibility requirements.

a. Accessible Routes: A minimum of three (3) elevations at each edge and centerline (cross-section; edge, center, edge), spaced at a minimum distance of ten (10) feet along the Accessible Route.

b. Ramps: Elevation shall be depicted with a minimum of three (3) elevations at the bottom of the sloped segment (edge/center/edge), three (3) elevations at the top of the sloped segment(edge/center/edge), and one (1) elevation at the center of the sloped segment (center). Elevation of landings associated with a ramp shall be depicted with a minimum of four (4) elevations at each corner and one (1) elevation at the center.

c. Curb Ramps: Elevation shall be depicted with a minimum of three (3) elevations at bottom of the accessible ramp section (edge/center/edge), three (3) elevations at the

top of the accessible ramp section (edge/center/edge), and one (1) elevation at the center of the sloped segment (center). Elevation of flare (wings) sections (wings) shall be depicted with a minimum of three (3) elevations at each triangle corner.

d. Accessible Parking Spaces: Elevation of each Accessible Parking Space and elevation of each Access Isle shall be depicted with a minimum of four (4) elevations at each corner and one (1) elevation at the center, respectively.

C. Submit two prints of the final as-built drawings to Engineer prior to submittal of Application for Final Payment. As-Built Drawings shall show, but not necessarily be limited to, the following information:

1. Location, grade, elevations, cross-section, invert, and alignment of earthwork, above-grade construction, structures, field layouts, field markings, and equipment.

2. Measured horizontal and vertical locations of underground utilities, drainage systems and associated appurtenances, referenced to permanent surface improvements.

3. Field changes of dimension and detail.

4. Detail not on original Contract Drawings.

5. Changes or modifications which result from punch lists or final inspection.

D. After approval of final as-built drawings by Engineer, submit two copies of final as-built drawing on polyester film to the Owner. Final as-built drawings shall bear the seal and signature of the Connecticut-licensed Professional Land Surveyor.

E. Concurrent with submittal of as-built drawings, submit to Owner all Survey Data in native format with appropriate identifiers.

END OF SECTION

SECTION 01 7700

PROJECT CLOSE-OUT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Substantial Completion.

2. Warranties.

3. Inspections.

4. Final cleaning.

5. Final Acceptance.

6. Project record documents.

1.2 SUBMITTALS

A. Submit Close-Out Submittals as indicated herein. Provide other Close-Out submittals that may be called-for in other Specification Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following (list exceptions in the request).

B. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as Substantially Complete. Include supporting documentation for completion as indicated in the Contract Documents and a statement showing an accounting of changes to the Contract Sum if applicable.

C. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

D. Submit warranties, workmanship bonds, maintenance agreements, testing results, final certifications, and similar documents.

E. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

F. Deliver spare parts, extra stock, equipment, and similar items required.

G. Complete start up testing of systems, and instruction of the Owner’s operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock ups, and similar elements.

H. Complete final clean up requirements, including touch up painting. Touch up and otherwise repair and restore marred exposed finishes.

I. Coordinate temporary erosion and sedimentation control measures with permanent erosion control features to the extent practical to ensure economical, effective and continuous erosion control post-construction.

1.4 INITIAL CLOSE-OUT INSPECTION

A. On receipt of a request for inspection, Engineer will either proceed with inspection or advise Contractor of unfilled requirements.

B. Following Initial Inspection, Engineer will prepare a list of items to be completed or corrected ("Punch List").

C. Engineer will prepare a Certificate of Substantial Completion following Initial Inspection, or advise Contractor of construction that must be completed or corrected before the certificate will be issued. If a Certificate of Substantial Completion is issues, the Punch List will be attached.

1.5 WARRANTIES

A. Submit written warranties to Engineer prior to the date certified for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of Engineer.

1.6 FINAL CLEANING

A. Remove all temporary controls unless otherwise indicated to remain.

B. Remove tools, construction equipment, machinery, and surplus materials.

C. Remove and properly dispose of all garbage, rubbish, litter, and other substances.

D. Clean exposed surfaces of installed equipment and similar items.

1.7 FINAL CLOSE-OUT INSPECTION

A. On receipt of a request for Final Inspection, Engineer will either proceed with inspection or advise Contractor of unfilled Punch List requirements.

B. Results of the Final Inspection will form the basis of requirements for final acceptance.

C. Engineer will repeat Final Inspection following notation of Punch List items that must be completed or corrected.

1.8 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final acceptance and final payment, complete the following (list exceptions in the request).

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum if applicable.

3. Submit Consent of Surety to final payment, and final lean releases (lien waiver) from all suppliers, subcontractors, and second-tier subcontractors.

B. Following completion of acceptable Close-Out Inspection and receipt of all required Close-Out Submittals, Engineer will prepare a certificate of final acceptance.

1.9 RECORD DOCUMENT SUBMITTALS

A. Record Drawings: In addition to Record Drawing requirements that may be defined in individual Specification Sections, at a minimum, maintain a clean, undamaged set of blue or black line white prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever Drawing is most capable of 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 concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

3. Note related Change Order numbers where applicable.

4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

5. Upon completion of the project, submit (2) copies of Record Drawings to Engineer.

B. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark up of Record Drawings and Specifications.

1. Upon completion of mark up, submit complete set of record Product Data to Engineer.

C. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to Engineer.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 7839

RECORD DOCUMENTS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. As-Built Survey.
5. Miscellaneous record submittals

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings:

1. Submit two (2) sets of marked-up record prints.
2. Submit record Drawings as follows:
   a. Initial Submittal
      1) Submit two (2) printed paper set(s) of marked-up record prints.
      2) Submit one (1) electronic file of scanned record prints in Portable Document Format (.pdf).
      3) Submit record digital data files in .dwg format and one (1) paper print.
      4) Engineer will indicate whether general scope of changes, additional information recorded.
   b. Final Submittal
      1) Submit two (2) printed paper set(s) of marked-up record prints.
      2) Submit one (1) electronic file of scanned record prints in Portable Document Format (.pdf).
      3) Print each drawing, whether or not changes or additional information were recorded.

B. Record Specifications: Submit one (1) electronic file in .pdf format of the Project Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one (1) electronic file in .pdf format of each submittal.

D. Where product data is required as part of operation and maintenance manuals, submit duplicate marked-up product data as a component of the manual.

E. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities.

F. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Accurately record information in an acceptable drawing technique.

c. Record data as soon as possible after obtaining it.

d. Record and check the markup before enclosing concealed installations.

e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.

b. Revisions to details shown on Drawings.

c. Locations and depths of underground utilities.

d. Revisions to routing of piping and conduits.

e. Actual equipment locations.

f. Locations of concealed internal utilities.

g. Changes made by Change Order or Construction Change Directive.

h. Changes made following Engineer’s written orders.

i. Details not on the original Contract Drawings.

j. Field records for variable and concealed conditions.

k. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.

2. Format: .dwg Version 2013 or later, Microsoft Windows operating system.

3. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.

4. Refer instances of uncertainty to Engineer for resolution.

5. Engineer will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Engineer determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.

2. Consult Engineer for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation “PROJECT RECORD DRAWING” in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Format: Annotated PDF electronic file with comment function enabled.

3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

4. Identification: As follows:

    a. Project name.

    b. Date.

    c. Designation “PROJECT RECORD DRAWINGS.”

    d. Name of Engineer.

    e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.

5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

1.5 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Include significant changes in the product delivered to Project site and changes in manufacturer’s written instructions for installation.

3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.6 AS-BUILT SURVEY

A. Submit as-built surveys in accordance with applicable Specification Sections.

1.7 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer’s reference during normal working hours.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

DIVISION 02
EXISTING CONDITIONS

SECTION 02 3219

EXPLORATORY EXCAVATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation of test pits where it may be necessary to locate or examine soils, groundwater, drains, pipes, rock, utilities, subsurface structures, or any other obstacles or subsurface conditions.

2. Stockpiling, management, and disposal of surplus or unsuitable material.

3. Backfilling and compacting of test pits with suitable material.

B. Exploratory excavations shall be conducted where shown on the Drawings, where directed or approved by Engineer, and as Contractor may deem necessary to locate or examine subsurface conditions as part of his work.

C. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

D. Contractor is responsible for all health and safety.

1.2 PAYMENT

A. Exploratory excavation work conducted by Contractor for his use or as specifically called-for on the Drawings or in the Specifications shall be considered incidental work and shall be included in Contractor's base price for the project. Contractor shall be responsible for any required backfilling with suitable materials, disposal of unsuitable excavated materials, and restoration of the excavation area.

B. Exploratory Excavation requested by Engineer shall be paid for in accordance with Contractor's Unit Price bid for "Exploratory Excavations" per Section 01 2200 – Unit Prices.

1.3 REFERENCES

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

B. United States Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

1.4 SAFETY

A. Contractor shall conduct all excavation activities in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.

B. Contractor shall provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.

C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.

D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to construct permanent or temporary excavation support systems, including, but not necessarily limited to, sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping, and benching.

E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate for the condition.

1.5 SUBMITTALS

A. Submit record data of observations noted in test pits, including photographs, diagrams, and descriptive notes.

1.6 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.

B. Utility Mark-out

1. Prior to commencing work, comply with utility mark-out requirements of the Call-Before-You-Dig System (1-800-922-4455).

2. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.

3. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work. Field-mark utilities as required.

C. Utility Coordination

1. Inform all utility owners of the necessity of test pit work. Prove reasonable advance notice to allow for coordination.

2. Coordinate the excavation of all test pits with the respective utility owners having facilities in the vicinity of the test pit location.

3. If so desired by the respective utility owners, all or part of the work under this Section may be accomplished by their crews and/or supervised by them.

D. Utility Protection

1. Safeguard and protect from damage any utility to remain in service. Before excavating near any utility, notify the utility owner, coordinate protective work, and comply with the utility owners' requirements.

2. Where utilities are encountered, notify Engineer and document location and type of utility before proceeding with work in such area.

3. When uncharted or incorrectly charted piping or utilities are encountered during excavation, stop work and notify Engineer immediately. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.

E. Retaining Structures

1. Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utilities, paving, light standards, piping or conduit. Assume responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto.

1.7 SEQUENCING

A. Contractor shall provide Engineer a minimum two (2) day notice prior to test pit excavation. Notify Engineer prior to backfill.

B. If test pits are required during the work to evaluate unforeseen conditions, notify Engineer as soon as the need for such work is known.

C. Notify Engineer and/or utility companies of any conflicts or other conditions observed which may require design revisions, relocations, and/or adjustment. No work shall be started within areas where conflicts or other conditions are observed which require design revisions, relocations, and/or adjustment until authorized by Engineer.

PART 2 PRODUCTS – NOT USED

2.1 SOILS

A. Refer to Section 31 2310 – Earthwork.

PART 3 EXECUTION

3.1 EXCAVATION

A. Test pit excavation and backfill shall comply with applicable provisions of earthwork and excavation as indicated in other applicable Specification Sections.

B. Excavation of test pits shall be accomplished by such means as are required to ensure that underground utilities or structures which may be encountered are not damaged.

C. Contractor shall measure and record the size, configuration, exact horizontal and vertical location of all utilities, pipes or other conditions/obstacles encountered.

D. Contractor shall be solely responsible for any damages incurred during excavation operations. Any such damages shall be repaired or replaced by Contractor to the satisfaction of the facility owner/operator, responsible/administering agency, and/or Engineer. Whether repair and/or replacement is Conducted by Contractor or must be conducted by owner/operator or responsible/administering agency, any and all costs thereof, including those costs associated with planning, coordination and owner/operator or responsible/administering agency personnel, shall be borne by Contractor.

E. Where an existing pavement has been removed for test pit excavation, the surface shall be restored in accordance with the Drawings and Specifications. In all other areas, the surface of test pit areas shall be backfilled and the surface restored to a condition equal to original, unless otherwise indicated by Engineer.

END OF SECTION

SECTION 02 4113

UTILITY DEMOLITION AND ABANDONMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Termination of utility services.

2. Demolition or abandonment of drainage, sewer, and water pipe

3. Demolition or abandonment of miscellaneous below-grade utilities and related facilities including but not necessarily limited to electric and communications ducts, steam lines, and gas lines.

4. Demolition or abandonment of manholes, catch basins, vaults, and similar utility structures.

5. Demolition or abandonment of above-grade utilities and related facilities including but not necessarily limited to electric, telephone, cable systems, and data communications.

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. State of Connecticut.

1. State of Connecticut Solid Waste Management Regulations, Sections 22a-209 including any amendments thereto.

2. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 817, 2016 and any supplements.

D. ASTM International (ASTM)

1. ASTM C33 – Standard Specification for Concrete Aggregates.

2. ASTM C55 – Standard Specification for Concrete Building Brick.

3. ASTM C91 – Standard Specification for Masonry Cement.

4. ASTM C94 – Standard Specification for Ready-Mixed Concrete.

5. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.

6. ASTM C 150 – Standard Specification for Portland Cement.

7. ASTM C230 – Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.

8. ASTM C270 – Standard Specification for Mortar for Unit Masonry.

9. ASTM C387 – Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.

10. ASTM C476 – Standard Specification for Grout for Masonry.

11. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

1.3 SAFETY

A. Conduct the work of this Section in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.

B. Provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.

C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.

D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to construct permanent or temporary excavation support systems, including, but not necessarily limited to, sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping, and benching.

E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate for the condition.

1.4 SUBMITTALS

A. Abandonment procedures required by the owner of each utility prior to performing the work of utility termination/cutting/capping/plugging.

B. Material specifications and shop drawings for all materials and equipment furnished under this section, prior to performing the work of utility abandonment.

C. Schedule indicating the timing of termination for each utility.

D. Copies of permits, licenses, approvals, insurance, or bonds associated with termination of utility service.

E. Copies of utility termination letters confirming termination of service from each utility owner/operator.

F. Quality Control Submittals (prior to commencement of work)

1. Schedule of demolition activities.

2. Methods of demolition, including sequence and equipment proposed for same.

G. Contract Closeout Submittals (prior to authorization of final payment):

1. As-built drawings showing locations of all terminated/cut/capped/plugged utilities and service disconnections at or before project close-out.

1.5 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.

B. Utility Mark-out

1. Prior to commencing work, comply with utility mark-out requirements of the Call-Before-You-Dig System (1-800-922-4455).

2. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.

3. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work. Field-mark utilities as required.

C. Utility Coordination

1. Inform all utility owners of the necessity of test pit work. Prove reasonable advance notice to allow for coordination.

2. Coordinate the excavation of all test pits with the respective utility owners having facilities in the vicinity of the test pit location.

3. If so desired by the respective utility owners, all or part of the work under this Section may be accomplished by their crews and/or supervised by them.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with the material specifications required by the owner of each utility. Where such material specifications may conflict with this Specification, utility owner’s requirements shall prevail.

B. Gravel Borrow: Conform to applicable Specifications.

C. Sand: ASTM C33.

D. Portland Cement: ASTM C150, Type II.

E. Masonry Cement: ASTM C91.

F. Mortar Aggregate: ASTM C144, standard masonry type, clean, dry, free of deleterious materials.

G. Concrete: Design of mix in accordance with ASTM C94; ASTM C150, Type II Portland Cement, washed and graded sand, and aggregate with maximum size of 1-inch; or pre-packaged concrete mix with maximum aggregate size of 1-inch, ASTM C387. Minimum 28-day compressive strength of 4,000 psi.

H. Masonry Mix: Washed and graded mason sand, lime, and Portland Cement, ASTM C270; or pre-packaged, dry, sand/lime/cement mortar mixture, ASTM C387. Minimum 28-day compressive strength of 1,800 psi (Type S).

I. Grout: Bagged, pre-mixed formulations of non-shrink grout shall meet the requirements of ASTM C1107, Grade B or site mixed, ASTM C476.

1. Unconfined compressive strength: 7,500 psi at 28 days.

2. Grout shall be non-metallic, non-gaseous, and non-shrink when tested in accordance with ASTM C1107 Grade B or C at a fluid consistency (flow cone) of 20 to 30 seconds. Thirty-minute-old grout shall flow through the flow cone after slight agitation, in temperatures of 40 degrees F to 90 degrees F.

3. Mix Design: Obtain prior written approval of Engineer for any proposed mix design. Mix design shall include the proportions of hydraulic cement, potable water, fine aggregates, expansive agent, and any other necessary additive or admixture.

4. Grout shall be mixed to a flowable consistency as determined by ASTM C230. All bagged material shall be clearly marked with the manufacturer's name, date of production, batch number, and written instructions for proper mixing, placement and curing of the product.

5. Contractor may formulate and design a grout mix for use on the project in lieu of using a pre-bagged product.

J. Water: Potable.

K. Solid Concrete Masonry Unit: ASTM C55, sized per pipe diameter to minimize requirements for cutting.

PART 3 EXECUTION

3.1 GENERAL

A. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any hazardous conditions and/or discrepancies.

B. Existing utilities at the Project Site have not been clearly defined as to location, size, and as-built condition, and all utility information shown on the Drawings or described herein must be considered approximate.

C. Primary structures and other site features are shown on the Drawings; other smaller structures and features not shown on the Drawings may exist and shall be demolished as part of the work of this Section at no additional cost.

D. Contractor shall have sole responsibility for verification of actual field conditions. Contractor shall bear full responsibility for obtaining information regarding the location, layout, and as-built configuration of existing site improvements, including aspects of such improvements which are not readily visible, including but not necessarily limited to above-ground and underground utilities, utility structures, their connections, and other above- and below-grade construction that my affect, or be affected by, the work of this Seciton.

E. Utility services to buildings outside the limits of work shall be maintained and all resulting costs or charges shall be the responsibility of Contractor.

F. Although surficial features such as manholes, catch basins, valves and junction boxes may be visible and/or shown on the Drawings, Contractor is required to perform exploratory excavations as he deems appropriate to ascertain the location and nature of all subsurface utilities components which are to be terminated, abandoned, or demolished, or otherwise affected by the work.

G. Provide all required coordination with owners of the various utilities serving, or present at, the Project Site as required to complete termination, demolition and abandonment work.

H. Prior to physically cutting, disconnecting, demolishing or abandoning any facility, verify that service has been terminated and no active connections remain.

I. Coordinate as required for permanent termination of service, temporary termination of service, relocation of facilities, abandonment of facilities, demolition of facilities, cutting, capping, plugging, and bracing.

J. Comply at all times with the procedures for terminations of utility services as required by the owner of each utility.

K. When utilities are encountered that are not indicated on the Drawings, notify Engineer before proceeding with the work.

3.2 PROTECTION OF UTILITIES

A. Locate and identify existing utilities that are to remain and protect them from damage. Provide protection as required such as marking, blocking, bracing, stabilizing, supporting, and retaining.

B. Before excavating near any utility, notify the utility owner, coordinate protective work, and comply with the utility owners' requirements.

C. When uncharted or incorrectly charted utilities are encountered during excavation, stop work and notify Engineer immediately. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.

D. Utilities to remain which are damaged by Contractor shall be repaired/replaced to the satisfaction of the utility owner at Contractor's expense.

E. Retaining Structures

1. Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utilities, paving, light standards, piping or conduit. Assume responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto.

3.3 UTILITY TERMINATION

A. Termination: Where "Terminate" is indicated, permanently terminate utility service as indicated on the Drawings in accordance with each utility owner's specific requirements, or coordinate with the utility owner in those cases where the utility owner will perform termination.

B. Coordinate and secure required permits, licenses, approvals, insurance, or bonds associated with termination of service.

C. Coordinate inspections by utility company personnel, or if privately-owned, coordinate inspections by qualified, authorized personnel on behalf of the utility owner.

D. Provide completed and executed utility termination forms as required by each utility owner's requirements.

E. Secure any required utility termination letters from each utility which confirm that service has been terminated and no active connections remain.

F. Termination Procedure

1. Water

a. Do not impact any water pipe that may be constructed of asbestos-containing materials unless asbestos abatement specifications are part of the contract documents and the work is completed by qualified personnel in accordance with the requirements contained therein.

b. Cut and cap water pipe as indicated on the Drawings or in accordance with the water utilities' requirements. Do not leave "dead-end" pipe runs.

c. Provide restraining blocks at all capped ends.

2. Electrical and Communications

a. Remove conductors to nearest structure unless otherwise indicated. Plug openings in structures per the details or in accordance with the utilities' requirements.

b. Cut and cap conduits at each end. Caps shall match conduit type.

c. Direct-Bury Cable: Comply with the cable owner's requirements.

d. Secure termination documentation.

3. Gas

a. Comply with gas company requirements.

4. Steam

    a. Prior to impacting any steam pipe, confirm that no asbestos-containing materials are present, or confirm that all asbestos-containing materials have been properly abated.

    b. Provide concrete plug at open ends.

3.4 UTILITY ABANDONMENT

A. Abandonment: Where "Abandon" or "Abandon in-place" is indicated, terminate utility service, cut, cap and otherwise separate the facility from portions to remain and implement abandonment procedure as defined herein.

B. Sewer and Drainage Systems

1. Less than 6 inches in diameter: Provide 6-inch concrete plug at open ends on either side of the length to be abandoned as indicated on the Drawings.

2. Greater than 6 inches in diameter: Fill abandoned section with grout/flow-fill and provide 6-inch concrete plugs on either side of the length to be abandoned as indicated on the Drawings.

    a. Where the filling of pipe is called-for, submit plan of proposed procedure to the owner of such utility and Engineer for approval.

    b. Filling of pipe shall be with pressure (pumping) methods.

3. Where the filling of pipe or conduit is called-for, Contractor shall submit a plan of his proposed procedure to the owner of such utility and Engineer for approval.

4. All structures which are to be abandoned in-place shall have their tops or roof slabs removed and floor slabs broken so as to permit the free passage of water.

5. Unless otherwise indicated, structures which are to be abandoned in-place may be demolished such that only that portion of the structure from finished grade to a point five feet below finished grade are removed.

C. Water Pipe

1. Do not impact any water pipe that may be constructed of asbestos-containing materials unless asbestos abatement specifications are part of the contract documents and the work is completed by qualified personnel in accordance with the requirements contained therein.

2. Cut and cap water pipe on either side of the length to be abandoned as indicated on the Drawings.

3. Provide restraining blocks at all capped ends of water pipe to remain in service.

D. Electrical and Communications

1. Remove conductors to nearest structure unless otherwise indicated.

2. Cut and cap conduits on either side of the length to be abandoned as indicated on the Drawings. Caps shall match conduit type.

E. Gas

1. Comply with gas company requirements.

F. Steam

1. Prior to impacting any steam pipe, confirm that no asbestos-containing materials are present, or confirm that all asbestos-containing materials have been properly abated.

2. Provide concrete plug on either side of the length to be abandoned as indicated on the Drawings.

G. Utility Structures

1. Comply with utility owner's requirements.

2. All structures which are to be abandoned in-place shall have their tops or roof slabs removed and floor slabs broken so as to permit the free passage of water.

3. Unless otherwise indicated, structures which are to be abandoned in-place may be demolished such that only that portion of the structure from finished grade to a point five feet below finished grade are removed.

4. Backfill to match adjacent grade and restore surface area to match adjacent grade unless otherwise indicated.

3.5 UTILITY DEMOLITION

A. Where "Remove," "Demolish," or "R&D" is indicated on the Drawings, such facility or structure shall be completely removed and disposed-of, after termination.

B. Subsurface Utilities: Demolition shall include complete removal of the utility system and any associated concrete encasement, catch basins and related structures; sanitary sewerage manholes, pumps, and related facilities; valves, backflow devices, vents, reducers, couplings, meters, hydrants, fittings, thrust blocks, anchors; vaults, pull boxes, splice boxes, and handholes; or other ancillary components of the utility located within the limits to be demolished. The plugging or capping of utilities at the limit of demolition shall be as indicated on the Drawings. Where no plugging or capping is shown, comply with the requirements for utility termination at the limit of demolition.

C. Above-grade Utilities: Demolition shall include complete removal of the utility system and any associated utility poles, guys, wires, transformers, light standards, utility and light pole foundations, supports and ancillary equipment.

D. Do not demolish any utility until termination and plugging/capping has been completed and verified.

E. Prior to the demolition of any lighting system, verify that power supplies which may be shared with other lighting systems outside the Project Limits have been segregated.

F. Asbestos-Containing Materials

1. Do not impact any asbestos-insulated utility where "Remove" or "Demolish" is indicated on the Drawings until all asbestos-containing materials have been properly abated and verification of same has been either

    a. Completed and verified by qualified personnel; or

    b. If asbestos abatement specifications are part of the contract documents the work has been completed by Contractor's qualified personnel or subcontractor in accordance with the requirements contained therein.

2. Do not impact any asbestos-containing pipe where "Remove" or "Demolish" is indicated on the Drawings unless asbestos abatement specifications are part of the contract documents and the work is completed by qualified personnel in accordance with the requirements contained therein. If asbestos abatement specifications are not part of the contract documents coordinate with Owner's abatement contractor for completion of the work.

3.6 MATERIAL DISPOSITION

A. Salvage of Utility Materials

1. If requested by the utility owner, frames and covers of manholes and catch basins to be demolished or abandoned shall remain the property of the utility owner. They shall be removed and transported to a designated storage area by Contractor.

2. Notify the utility owner at least 24 hours before salvaged materials are transport so that the exact place and time for delivery can be arranged.

3. Other utility materials which are to be salvaged or reused are indicated on the Drawings.

B. Disposal of Utility Materials

1. The loading of utility demolition materials for disposal shall be performed in a manner that prevents materials and activities from generating excessive dust and ensure minimum interference with roads, sidewalks and streets both onsite and offsite.

2. Transport of all materials off-site shall be in accordance with applicable Department of Transportation Regulations. All utility demolition materials leaving the site shall become the property of Contractor.

3. Disposal of utility demolition materials shall be conducted in accordance with all applicable regulations and occur only at facilities approved/licensed or permitted by the Connecticut Department of Energy and Environmental Protection.

4. Disposal of Demolition Materials: All materials resulting from utility demolition shall be removed from the Project Site by Contractor for disposal, reuse, salvage or recycling. Disposal shall be conducted in accordance with all applicable regulations.

3.7 FILL AND BACKFILL

A. Backfill excavations from utility work in accordance with Specification Section 31 2310 – Earthwork.

3.8 DOCUMENTATION

A. Field Identification

1. Physically mark the location of each subsurface utility termination with a surveyor's stake, with such stake identifying the utility type and depth below grade. Where the use of stakes at a utility termination location may be inappropriate, Contractor shall provide staking at an adjacent location(s) and include appropriate offset dimensions or other suitable demarcation.

B. As-Built Drawings

1. Provide as-built documentation for each utility termination, including location, depth, and method and material of construction for termination. Such as-built documentation shall be noted on the appropriate Drawings.

2. Contractor shall be solely responsible for complying with the requirements of local permitting authorities for preparation and submittal of as-built drawings. The requirements for the preparation of as-built drawings as defined herein shall be considered the minimum requirements of Engineer, but shall in no way relive Contractor from satisfying the requirements of local permitting authorities.

3. As work progresses, record the following on two (2) sets of Drawings:

4. All changes and deviations from the design in location, grade, size, material, or other feature as appropriate.

5. Any uncharted locations of utilities or other subsurface feature encountered during installation, including the characteristics of such uncharted utility or subsurface feature such as utility type, size, depth, material of construction, etc.

6. Recording of changes shall be clearly and neatly marked in red pen or pencil. All changes shall be noted on the appropriate Drawing sheets.

7. Make measurements from fixed, permanent points on the Project Site to accurately locate the work completed. Such measurements shall consist of at least three (3) ties showing the distance of each item relative to each of the fixed, permanent points.

8. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall also contain any additional information required by Engineer.

3.9 CLEAN UP

A. Contractor shall remove all debris, residuals, and materials at the conclusion of utility termination, demolition, and abandonment activities.

END OF SECTION

SECTION 02 4123

SITE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. General Site Demolition.

2. Demolition of site structures, retaining walls, signage, light standards, foundations and appurtenances, pavement, curbing, and similar site improvements.

3. Filling of voids and excavations resulting from site demolition.

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. State of Connecticut.

1. State of Connecticut Solid Waste Management Regulations, Section 22a-209 including any amendments thereto.

1.3 DEFINITIONS

A. Demolition: Any operation including the dismantling or wrecking of a structure, assembly, appurtenance, or any portion thereof, including major and minor components, parts, and systems. Demolition shall be inclusive of the removal, handing, processing, segregation, loading, and proper off-site disposition of materials. Demolition shall be interpreted as complete and total removal unless otherwise indicated. The term Remove shall be synonymous with Demolition.

B. Bulky Waste: Land clearing debris and non-contaminated or hazardous waste material resulting directly from demolition activities other than Clean Fill, including such materials as tree stumps, tree tops, concrete, wood, brick, plaster, roofing materials, wallboard, metals, carpeting, insulation, furniture, and furnishings. Bulky Waste shall include Construction and Demolition Debris and Construction and Demolition Waste.

1.4 SAFETY

A. Conduct all work in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.

B. Provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.

C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.

D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to construct permanent or temporary excavation support systems, including, but not necessarily limited to, sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping, and benching.

E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate for the condition.

1.5 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.

B. Utility Mark-out

1. Prior to commencing work, comply with utility mark-out requirements of the Call-Before-You-Dig System (1-800-922-4455).

2. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.

3. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work. Field-mark utilities as required.

C. Utility Coordination

1. Inform all utility owners of the necessity of test pit work. Provide reasonable advance notice to allow for coordination.

2. Coordinate the excavation of all test pits with the respective utility owners having facilities in the vicinity of the test pit location.

3. If so desired by the respective utility owners, all or part of the work under this Section may be accomplished by their crews and/or supervised by them.

1.6 REGULATORY REQUIREMENTS

A. Comply with all applicable federal, state, and local safety and health requirements regarding all aspects of the work. Do not proceed until all permits or other approvals are secured.

B. Contractor is bound to comply with any project-related permits or approval obtained by Owner, including all requirements of such permit and representations contained in permit application as though Contractor were the permittee. Requirements and conditions set forth in Owner-obtained project-related permits and permit applications shall be binding on Contractor just as any Specification would be.

C. Do not close or obstruct roadways, sidewalks, hydrants, or other infrastructure without permits or authorization from local municipal authorities or other authorities having jurisdiction.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 IDENTIFICATION OF EXISTING FEATURES

A. Prior to commencing construction activities, Contractor shall identify and delineate those areas or specific improvements that are not to be disturbed. Areas or specific improvements within the Limits of Work/Contract Limits and general work areas which are not to be disturbed shall be clearly marked or fenced. Monuments and markers shall be protected before construction operations commence. Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting designated areas, specific improvements, monuments, and markers at the Project Site.

3.2 PROTECTION OF EXISTING FEATURES

A. General

1. All areas or specific improvements, including but not limited to vegetation, utilities, poles, wires, fences, curbs, monuments/property-line markers, and other structures, which must be preserved in place without being temporarily or permanently relocated shall be carefully supported and otherwise protected from damage by Contractor.

2. As excavation/demolition work approaches underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools.

B. Pavements

1. On paved surfaces to remain, Contractor shall not use or operate heavy equipment, other power-operated equipment, or store tools, equipment, or materials which may mar, cut, or otherwise damage such surfaces. If there is no alternative to the operation of heavy equipment, other power-operated equipment, or storage of tools, equipment, or materials on paved surfaces to remain, Contractor shall take all measures necessary to protect such surfaces.

2. All surfaces, which have been damaged by Contractor's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of construction operations. Such restoration shall meet the approval of Engineer and may include repair or complete replacement at Contractor's expense.

C. Planted Areas

1. All planted areas, including lawn/turf areas and landscaped areas, which have been damaged by Contractor's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of construction operations.

D. Utilities

1. Locate and identify existing utilities that are to remain and protect them from damage. Provide protection as required such as marking, blocking, bracing, stabilizing, supporting, and retaining.

2. For utility termination, removal, or abandonment, refer to Section 02 4113 – Utility Demolition and Abandonment.

3. Before excavating near any utility, notify the utility owner, coordinate protective work, and comply with the utility owners' requirements.

4. All utility services shall be supported by suitable means so that the services shall not fail when tamping and settling occurs.

5. Where known utilities are encountered, notify Engineer and document location and type of utility before proceeding with work in such area.

6. When uncharted or incorrectly charted utilities are encountered, stop work and notify Engineer. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.

E. Retaining Structures: Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utility systems, paving, or other improvements. Contractor assumes responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto.

3.3 SITE DEMOLITION

A. Conduct site demolition as shown on the Drawings.

B. Conduct site demolition operations in a manner that will prevent damage to adjacent structures, utilities, pavements and other facilities to remain.

C. Remove from the site and properly dispose of all materials resulting from site demolition operations.

3.4 DUST CONTROL

A. Implement fugitive dust suppression to prevent unacceptable levels of dust resulting from site demolition operations or other activities required by the Contract Documents. It shall be the Contractor's responsibility to supervise fugitive dust control measures and to monitor airborne particulate matter. Comply with applicable provisions of Section 01 5714 – Temporary Dust Control.

3.5 REPLACEMENT

A. In case of damage, Contractor shall notify the appropriate party so that proper steps may be taken to repair any and all damage done. When the Owner does not wish to make the repairs themselves, all damage shall be repaired by Contractor, or, if not promptly done by him, Engineer may have the repairs made at the expense of Contractor.

B. Contractor shall patch, repair and/or replace all adjacent materials and surfaces damaged through the prosecution of work at no expense to Owner. All repair and replacement work shall match the existing in-kind. Final acceptance of said work shall be at the sole judgment of Owner.

END OF SECTION

DIVISION 03
CONCRETE

SECTION 03 3200

SITE CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes

1. Site cast-in-place concrete, including but not necessarily limited to, sidewalks, ramps, driveways, curbing, pads, bases, retaining walls, and thrust blocks.

2. All facilities, labor, materials, tools, equipment, appliances, transportation, supervision, and related work necessary to complete the Work shown on the Drawings and as specified herein.

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. ASTM International (ASTM)

1. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

2. ASTM A706 – Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

3. ASTM A767 – Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement

4. ASTM A775 – Standard Specification for Epoxy-Coated Steel Reinforcing Bars.

5. ASTM A996 – Standard Specification for Rail-Steel and Axle-Steel Deformed Bars or Concrete Reinforcement.

6. ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

7. ASTM C29 – Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
8. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
9. ASTM C33 – Standard Specification for Concrete Aggregates.
10. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
11. ASTM C42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
12. ASTM C70 – Standard Test Method for Surface Moisture in Fine Aggregate.
13. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
14. ASTM C117 – Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.
15. ASTM C127 – Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
16. ASTM C128 – Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
17. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
18. ASTM C138 – Standard Test Method for Density ("Unit Weight"), Yield, and Air Content (Gravimetric) of Concrete.
19. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
20. ASTM C150 – Standard Specification for Portland Cement.
21. ASTM C156 – Standard Test Method for Water Retention by Concrete Curing Materials.
22. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete.
23. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.
24. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
25. ASTM C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
26. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
27. ASTM C233 – Standard Test Method for Air-Entraining Admixtures for Concrete.
28. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

29. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

30. ASTM C311 – Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.

31. ASTM C387 – Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.

32. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.

33. ASTM C566 – Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying.

34. ASTM C595 – Standard Specification for Blended Hydraulic Cements.

35. ASTM A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

36. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

37. ASTM C685 – Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

38. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete.

39. ASTM C803 – Standard Test Method for Penetration Resistance of Hardened Concrete.

40. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.

41. ASTM C979 – Standard Specification for Pigments for Integrally Colored Concrete.

42. ASTM C989 – Ground Granulated Blast-Furnace Slag for Use in Concrete Mortars.

43. ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.

44. ASTM A1078 – Standard Specification for Epoxy-Coated Steel Dowels for Concrete Pavement.

45. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

46. ASTM D1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

47. ASTM D2628 – Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

48. ASTM D4397 – Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.

49. ASTM D5249 – Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints.

50. ASTM D5893 – Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

51. ASTM E329 – Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

D. Concrete Reinforcing Steel Institute (CRSI).

1. CRSI Manual of Standard Practice, latest edition.

E. State of Connecticut

1. 2016 Connecticut State Building Code, including all Amendments, Supplements, and Errata.

F. American Concrete Institute (ACI)

1. ACI 224R – Control of Cracking on Concrete Structures.

2. ACI 224.3R – Joints in Concrete Construction.

3. ACI 301 – Specifications for Structural Concrete.

4. ACI 302.1R – Guide for Concrete Floor or Slab Construction.

5. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete.

6. ACI 305R – Guide to Hot Weather Concreting.

7. ACI 306R – Guide to Cold Weather Concreting.

8. ACI 308R – Guide to Curing Concrete.

9. ACI 318-14 – Building Code Requirements for Structural Concrete

10. ACI 318R-14 – Commentary on Building Code Requirements for Structural Concrete

G. American Welding Society (AWS).

1. AWS A5.1/A5.1M (2004; Errata 2004) Carbon Steel Electrodes for Shielded Metal Arc Welding.

2. AWS D1.4/D1.4M (2005; Errata 2005) Structural Welding Code – Reinforcing Steel.

1.3 SUBMITTALS

A. Sampling and Testing Laboratory – Submit name and qualifications of commercial sampling and testing laboratory for Engineer's approval. Submit applicable documentation of credentials, licenses, etc.

B. Testing Agency – Submit name and qualifications of third-party in-field quality control Testing Agency for Engineer's approval. Submit applicable documentation of credentials, licenses, etc.

C. For each type of specially furnished concrete provide a description of methods and the sequence of placement.

D. Manufacturer's catalog data for the following items shall include printed instructions for admixtures, bonding agents, epoxy-resin adhesive binders, waterstops, and liquid chemical hardeners:

1. Concrete Aggregates.
2. Portland Cement.
3. Ready-Mix Concrete.
4. Form Facing Materials.
5. Reinforcement Materials.
6. Joint Materials.
7. Water-Vapor Barrier Subgrade Cover.
8. Bonding Materials.
9. Finish Materials.
10. Concrete Curing Materials.
11. Form release agent.
12. Concrete coloring additive.
13. Elastomeric joint sealant.
14. Preformed joint filler

E. Submit samples of the following:

1. Preformed joint filler.
2. Manufacturer's color charts showing full range of colors available.
3. Cured samples of elastomeric join sealants in the color(s) selected.

F. Design Data

1. Mix Design data for each class of Ready-Mix Concrete shall be submitted at least 15 calendar days prior to start of specified work.

G. Test Reports

1. Submit test reports for all testing conducted under this Section.

H. Certificates

1. Submit certificates for the following:

   a. Concrete Design Mixes.

   b. Concrete Aggregates.

   c. Welding Procedures. Welding Procedures shall be in accordance with AWS D1.4/D1.4M. Certificates for Welder Qualifications shall be in accordance with the paragraph entitled, "Qualifications for Welding Work," of this section.

   d. Mill certificates for Steel Bar.

2. Certificates for concrete shall contain project name, title/number, date, name of Contractor, name of concrete testing service, source of concrete aggregates, material manufacturer, brand name of manufactured materials, material name, values as specified for each material, and test results.

I. Manufacturer's Instructions

1. Installation instructions shall indicate the manufacturer's recommended method and sequence of installation for the following items:

   a. Admixtures

   b. Bonding Materials

   c. Waterstops

   d. Liquid Chemical Hardener

J. Joint Plan

1. Prior to initiation of concrete flatwork, submit proposed Construction Joint plan to Engineer for review and approval. Coordinate such plan with the joint patterns depicted on the Drawings.

K. Delivery Tickets: Ready-mixed concrete manufacturer shall provide delivery tickets with each load of concrete delivered to the Project Site. Delivery tickets shall provide the following information:

1. Project name printed on ticket.

2. Name of producer, identification of plant.

3. Date and time of day.

4. Type of material.

5. Cubic yards of material loaded into truck.

6. Project number, purchase order number, name of Contractor (if Contractor other than producer).

7. Truck number for specific identification of truck.

8. Individual aggregate, cement, water weights (masses) and any admixtures shall be printed on plant tickets.

9. Water/cement ratio.

10. Additional water allowance in gallons based on water/cement ratio for mix.

1.4 QUALITY ASSURANCE

A. Dimensions, locations, and details of equipment pads, anchors, supports, and similar features indicated on the Drawings are approximate. Manufacturer's approved shop drawings of equipment to be supported, anchored, or contained thereby shall be consulted for exact location, size and details.

B. Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.

C. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.

D. Welder qualifications: Welder qualifications shall be verified in accordance with AWS D1.4/D1.4M or under an equivalent qualification test approved in advance. Welders shall be permitted to do only the type of welding for which each is specifically qualified.

E. Concrete testing: Concrete testing shall be performed by an approved Testing Agency/Testing Laboratory experienced in sampling and testing of concrete. Testing Agency/Testing Laboratory shall meet the requirements of ASTM E329.

1.5 MOCKUPS

A. Where mockups are called-for, comply with the following:

1. At location on the Project Site selected by Engineer, place and finish 100 square foot mockup section for examination. Mockup to be constructed by the installer who will actually perform the work for the Project.

2. For accurate color, the quantity of concrete mixed to produce the sample should not be less than 3 cubic yards (or not less than 1/3 the capacity of the mixing drum on the ready-mix truck) and should always be in full cubic yard increments. Excess material shall be discarded according to local regulations.

3. For colored concrete, record the amount of integral colorant, dray colorant, or chemical stain needed per square foot of application to establish coverage rates for the work.

4. Construct mockup using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control construction, and expansion joints in sample panels.

5. Retain samples of cements, sands, aggregates and color additives used in mockup for comparison with materials used in remaining work.

6. Accepted mockup provides visual standard for all work.

7. Mockup shall remain through completion of work for use as a quality standard for finished work.

8. Provide suitable protections to preclude damage to mockup.

9. Remove mockup when directed.

1.6 TESTING

A. Quality control testing during construction shall be the responsibility of Contractor via Testing Agency and Testing Laboratory as applicable. Contractor shall retain and pay for the services of such Testing Agency/Testing Laboratory to perform all testing in accordance with applicable standards.

B. Testing shall include sampling and testing concrete materials proposed for use in the work and testing the design mix for each class of concrete.

C. Tests will be required to determine whether the concrete being produced complies with the standard of quality and strength as specified.

D. Additional Tests: Additional testing of in-place concrete shall be conducted when test results indicate that specified concrete strengths and other characteristics have not been attained. Additional testing shall consist of cored cylinders to determine adequacy of concrete or other non-destructive testing methods that may be approved by Engineer. Contractor shall pay for all such additional testing. Any holes made shall be patched by the Contractor at their expense.

E. Testing Standards

1. Sampling: ASTM C172. Collect samples of fresh concrete to perform tests specified.

2. Concrete aggregate materials proposed for use in the work shall be sampled and tested in accordance with ASTM C33.

3. Portland Cement shall be sampled and tested in accordance with ASTM C150.

4. Slump Tests: ASTM C143. Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cement ratio is not exceeded.

   a. Frequency: Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete unless otherwise specified or called-for.

5. Air Content: ASTM C231 (primary method) or ASTM C173 (secondary method).

   a. Frequency: Test air-entrained concrete for air content at the same frequency as specified for slump tests.

6. Temperature Tests: ASTM C1064.

   a. Frequency: Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each

batch (minimum) or every 20 cubic yards (maximum) of concrete, unless otherwise specified or called-for, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

7. Compressive Strength Tests: ASTM C39. Make five test cylinders for each set of tests in accordance with ASTM C31. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve.

   a. Frequency: Samples for strength tests of each mix design (class) of concrete placed each day shall be taken not less than once a day, nor less than once for each 150 cubic yards of concrete, nor less than once for each 5,000 square feet of surface area for slabs (including walks and sidewalks) or walls.

   b. Standard: Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. If the average of any three consecutive strength test results is less than f'c or if any strength test result falls below f'c by more than 450 psi, take a minimum of three cored cylinder samples from the in-place work represented by the low test cylinder results and test. Concrete represented by core test is considered structurally adequate if the average of three cores is equal to at least 85 percent of f'c and if no single core is less than 75 percent of f'c. Retest locations represented by erratic core strengths. Remove concrete not meeting strength criteria and provide new acceptable concrete. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete

8. Cored cylinders: ASTM C42.

9. Penetration: ASTM C803.

F. Concrete Replacement: Failure of any test or to follow proper installation procedures will require that the concrete be removed and properly replaced at the Contractor's expense.

1.7 DELIVERY, STORAGE AND HANDLING

A. Schedule delivery of concrete to provide consistent mix times from batching until discharge. Mix times shall meet manufacturers' written recommendations.

B. Packaged materials shall be delivered to the project site in their original, unopened package or container bearing label clearly identifying manufacturer's name, brand name, material, weight or volume, and other pertinent information. Packaged materials shall be stored in their original, unbroken package or container in a weather-tight and dry place until ready for use in the work.

C. Unpackaged aggregates shall be stored to avoid excessive segregation, contamination with other materials or other size aggregates, or freezing.

D. Reinforcement and other metal items shall be protected from corrosion and shall be kept free from ice, grease, and other coatings that would destroy or reduce bond.

E. Colored Admixture: Comply with manufacturer's instructions. Deliver colored admixtures in original, unopened packaging. Store in dry condition.

1.8 PROJECT CONDITIONS

A. Pre-Job Conference

1. One week prior to placement of concrete, Contractor shall coordinate and host a coordination meeting to discuss concrete application schedule, materials, and methods.

B. Environmental Requirements

1. Avoid placing concrete if rain, snow, or frost is forecast within 24-hours.

2. Protect fresh concrete from rain, moisture, and freezing.

3. Schedule placement to minimize exposure to wind and hot sun before curing materials are applied.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT

A. Cement: ASTM C 150. One brand and type of cement shall be used for formed concrete having exposed-to-view finished surfaces.

B. Unless otherwise specified, cement shall be Type IA.

2.2 READY-MIX CONCRETE

A. Ready Mix Concrete: Portland Cement Concrete, air-entrained, ASTM C94.

1. Compressive Strength:

a. Unless otherwise indicated, minimum compressive strength at 28 days shall be 4,000 psi minimum.

b. Sidewalks, stairs and landings, pedestrian and vehicle ramps, and curbing: Minimum compressive strength at 28 days shall be 4,500 psi minimum.

2. Water/cement ratio: Maximum 0.45.

3. Air content by volume: 6 percent ± 1 percent, ASTM C231 (primary method) or ASTM C173 (secondary method).

4. Slump: no less than 2 inches, not greater than 4 inches, ASTM C143.

5. Standard Color: Natural grey.

6. Colored Concrete: See the Article “Integral Colorant” herein if applicable.

B. Aggregate

1. Coarse aggregate: ASTM C33. Broken stone or gravel consisting of clean durable fragments of uniform quality throughout. It shall be free from soft, disintegrated pieces, mud, dirt, organic or other injurious material. Coarse aggregate of a size retained on a 1-inch square opening sieve shall not contain more than 8% of flat or elongated pieces, whose longest dimension exceeds five times their maximum thickness.

2. Fine aggregate: ASTM C33. Sand consisting of clean, hard, durable, uncoated particles of quartz or other rock, free from lumps of clay, soft or flaky material, loam, organic or other injurious material. Fine aggregate shall contain not more than 3% of material finer than a #200 sieve, ASTM C117.

C. Water: Potable quality.

D. Admixtures

1. Concrete shall contain a water reducing agent, ASTM C494, to minimize cement and water content of the concrete mix at the specified slump.

2. Air-Entraining Admixtures: ASTM C260.

3. Pozzolan: Fly ash or other pozzolans used as admixtures shall conform to ASTM C618, Class C or Class F with 4 percent maximum loss on ignition. Pozzolan may be used to replace a maximum of 15 percent (15 %) of cement by weight.

4. No calcium chloride or admixtures containing calcium chloride shall be added to the concrete. No admixtures other than those specified shall be used in the concrete without the specific written permission of Engineer in each case.

2.3 FORMS

A. Forms shall be substantially built and adequately braced so as to withstand the liquid weight of concrete without deforming. All linings, studding, walling and bracing shall be such as to prevent bulging, spreading, or loss of true alignment while pouring and displacement of concrete while setting.

B. All edge forms for sidewalk pavements, curbs and gutters shall be of sufficient rigidity and adequately braced to accurately maintain line and grade. Form work shall be designed so that sections may be fastened together to prevent vertical or horizontal movement of ends.

C. Forms for curved sections shall be so constructed and placed that the finish surface of walls and edge of sidewalks, curbs and gutters will not deviated appreciably from the arc of the curve.

D. Exposed vertical and horizontal edges of the concrete in structures shall be chamfered as indicated on the Drawings by the placing of moldings in the forms.

E. Forms for Exposed Finish: Plywood, metal, metal-framed plywood faced, or other acceptable panel materials. Form work materials shall produce a smooth, continuous, straight, and level surface.

1. Plywood shall be APA A-A, A-B or A-C, Class 1, Exterior Grade. Thickness shall be as required to prevent movement or deformation but shall not be less than 5/8″ thick.

F. Forms for Non-Exposed Finish: Plywood, metal, metal-framed plywood faced, or other acceptable panel materials. Form work materials shall produce a generally smooth, continuous, straight, and level surface. Grain patterns or similar imperfections are acceptable. Lumber shall be dressed on at least two edges and one side.

1. Plywood shall be at least B-B, Class 1, Exterior Grade. Thickness shall be as required to prevent movement or deformation but shall not be less than 5/8″ thick.

G. Cylindrical Forms: Sonotube Fibre Forms, wax-impregnated strippable forms or ABS or PVC plastic reusable forms.

H. Form Ties: Provide prefabricated, adjustable length galvanized steel snap-off ties, with brackets, cones, corner locks and other accessories as necessary.

I. Form Release Agent: Commercial formulation compounds that will not bond with, stain or adversely affect concrete.

2.4 REINFORCEMENT MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60 unless otherwise indicated.

B. Galvanized Reinforcing Bars: ASTM A 767, Class II with galvanizing before fabrication.

C. Weldable Reinforcing Bars: ASTM A 706, Grade 60 unless otherwise indicated. Maximum carbon content shall be 0.55 percent.

D. Epoxy-Coated Reinforcing Bars: ASTM A 775, Grade 60 unless otherwise indicated.

E. Steel Wire: ASTM A 82, 16 gauge or heavier black annealed wire.

1. Ties for epoxy-coated bars shall be vinyl-coated or epoxy-coated.

2. Ties for zinc-coated bars shall be zinc-coated.

F. Welded Wire Reinforcement (WWR)

1. Sidewalks: Plain wire, ASTM A1064 as indicated on the Drawings.

2. Concrete Pavement: Plain wire, ASTM A1064 as indicated on the Drawings.

G. Supports for Reinforcement

1. Supports shall include bolsters, chairs, spacers, and other devices necessary for proper spacing, supporting, and fastening reinforcing bars and wire reinforcement in-place. Conform with CRSI Manual of Standard Practice for corrosion-resistant, plastic-protected wire, epoxy-coated, or stainless-steel supports.

2. For exposed-to-view concrete surfaces and where support legs are in contact with forms, provide supports with plastic protection (CRSI, Class1) or stainless steel protection (CRSI, Class 2).

H. Dowel Bars: Plain (smooth) high-chrome steel bar, ASTM A615 Grade 60 with full-length plastic sleeve as a combined unit, dimensions as indicated on the Drawings.

1. Where epoxy-coated dowels are called for: ASTM A1078.

I. Bar/Dowel Adhesive: Two component (1:1 ratio), 100% solids, high modulus, moisture-insensitive structural epoxy gel designed specifically for bonding bars, dowels, and bolts in concrete.

2.5 JOINT MATERIALS

A. Preformed Joint Filler Strips, Sidewalks and Concrete Paving.

1. Where no joint sealant is called-for: Nonextruding and resilient bituminous type conforming to ASTM D 1751, 1/2-inch-thick, one piece for the full depth and width of the joint.

2. Where joint sealant is called-for: Nonextruding and resilient nonbituminous type conforming to ASTM D 1752, Type I (sponge rubber) or Type II (cork), 1/2 inch thick, allowance for sealant at top and extending for the full depth and width of the joint.

B. Preformed Joint Filler Strips, General Use/Isolation Joints

1. Polyethylene, closed-cell expansion joint filler, ASTM D 4819, Type II.

C. Joint Sealant Compound, ASTM C920

1. Self-Leveling (Type SL; Grade “P”)

a. Cold-applied and self-leveling, Type S or Type M elastomeric polymer sealant.

2. Gun-Grade (Non-Sage; Grade “NS”)

a. One-component (Type S) high-performance moisture-curing polyurethane sealant specifically formulated for bonding to masonry and concrete.

3. Traffic Bound areas: T sealant.

4. Non-Traffic Bound areas: NT sealant.

5. Color: As approved by Engineer.

6. Backer material: ASTM D5249, closed cell.

2.6 CONCRETE BONDING MATERIALS

A. Aqueous-phase, film-forming, nonoxidizing, freeze and thaw-resistant compound suitable for brush or spray application conforming to ASTM C 932.

B. Epoxy-Resin Adhesive Binder: Two-component, penetrating high solids, epoxy-based primer/bond coat, 100% solids, moisture-tolerant, ASTM C-881, Types I, II, and V, Grade-2, Class C and AASHTO M-235.

2.7 CONCRETE CURING MATERIALS

A. Curing shall be by moist curing (preferred) or by use of curing compound. Sodium Silicate curing compounds shall be used where required by the weather, approved construction schedules and construction that is not adaptable to damp curing.

B. Curing compound shall be a resin-base, white pigmented compound, ASTM C309, Type 2.

C. Curing compounds shall contain a fugitive dye or when hot weather conditions dictate, a fugitive heat reflecting pigment.

D. Moisture-Retaining Cover:

1. Waterproof paper, ASTM C 171, regular or white.

2. Polyethylene sheeting, ASTM C 171.

3. Polyethylene-coated burlap consisting of a laminate of burlap and a white opaque polyethylene film permanently bonded to the burlap. Burlap: ASTM C 171, Class 3. Polyethylene film: ASTM C 171.

4. When tested for water retention in accordance with ASTM C 156, weight of water lost 72 hours after application of moisture retaining covering material shall not exceed 0.039 gram per square centimeter of the mortar specimen surface.

E. Water: Potable Quality.

F. Membrane-Forming Curing Compound

1. Liquid type, ASTM C 309, Type 1, clear, Type 2, white, pigmented.

2.8 BOND BREAKER

A. Asphalt felt conforming to ASTM D2626, Type I or 6-mil polyethylene sheeting, ASTM D4397.

2.9 SEALER

A. Consolideck® Saltguard® silane/siloxane water repellent and chloride screen as manufactured by Prosoco, Inc., 3741 Greenway Circle, Lawrence, KS 66046, or approved equal. Gloss or flat sealer type as selected by Owner.

PART 3 EXECUTION

3.1 GENERAL

A. Verify site conditions before proceeding with the work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any hazardous conditions and/or discrepancies.

B. Provide construction techniques in accordance with applicable provisions of ACI 224R, ACI 224.3R, and ACI 302.1R-04.

C. Engineer shall be notified of concrete placement sufficiently in advance of start of operation to allow their representative to complete preliminary inspection of the Work, including subgrade, forms, and reinforcing steel, if used.

D. Adjacent work, etc., shall be protected from stain and damage during entire operation. Damaged and stained areas shall be replaced or repaired to equal their original conditions at the contractor's expense. No concrete walks shall be poured after 12 noon unless a guard is visibly stationed nearby to prevent graffiti. Contractor shall be responsible for replacing any graffiti if he fails to provide adequate protection.

E. Concrete surface shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary, 1/2-inch thick plywood sheets shall be used to protect exposed surfaces.

F. Retempering of concrete is not permitted.

G. Contractor is responsible for the protection and resetting of all existing utility covers/castings to finish grade; as well as, setting all new utility covers/castings to finish grade prior to placement of concrete. The repair of any settlement, or protrusion above finish grade, shall be the responsibility of Contractor at no additional cost to Owner.

3.2 PREPARATION OF SUBGRADE

A. Compact and bring area to required subgrade elevation in accordance with Section 31 2310 – Earthwork. Provide for final fine grading, and compaction of areas as required to form a firm, uniform, accurate and unyielding subgrade at required elevations and to required lines.

B. Existing subgrade material, which will not readily compact as required, shall be removed and replaced with satisfactory materials in accordance with Section 31 2310 – Earthwork.

C. Subgrade of areas to receive concrete shall be recompacted as required to bring the top 8 inches of material, immediately below the base course, to a compaction at optimum moisture content of at least 95 percent (95%) of maximum density, as determined by ASTM D1557. Subgrade compaction shall extend for a distance of at least 1 foot beyond pavement edge.

D. Materials shall not be stored or stockpiled on subgrade.

E. Disposal of debris and other material excavated under this section, and material unsuitable for, or in excess of requirements for, completing work of this section shall be disposed of off-site.

F. Prepared subgrade shall be inspected and approved by Engineer Representative before installation of the gravel base course. Disturbance to subgrade caused by inspection procedures shall be repaired under this Section of the Specification.

3.3 AGGREGATE BASE COURSE

A. Prepare aggregate base course for concrete in accordance with Section 31 2310 – Earthwork and as shown on the Drawings.

B. Width of base course shall be greater than or equal to the width of concrete surface, if continuous lateral support is provided during rolling. The width of base course shall extend at least 2 x base thickness beyond the edge of the course above, if it is not so supported.

C. Aggregate shall be applied in lifts less than or equal to 6 inches thick, compacted measure. Each lift shall be separately compacted to specified density.

1. Material shall be placed adjacent to wall, manhole, catch basin, and other structures only after they have been set to required grade and level.

2. The base shall be wetted and rolled or tamped after the spreading of each lift.

3. Rolling shall begin at the sides and progress to the center of crowned areas, and shall begin on the low side and progress toward the high side of sloped areas. Rolling shall continue until material does not creep or wave ahead of roller wheels.

4. Surface irregularities, which exceed 1/2-inch, as measured by means of a 10-foot long straightedge, shall be replaced and properly re-compacted.

D. Density: Base course shall be compacted at optimum moisture content to not less than 95 percent of maximum density as determined by ASTM D1557.

E. Subgrade and base course shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with gravel. Materials spilled outside pavement lines shall be removed and the area repaired.

F. Portions of subgrade, or of construction above, which become contaminated, softened, or dislodged by the passing of traffic, or otherwise injured, shall be cleaned, replaced, or otherwise repaired to conform to the requirements of this specification before proceeding with the next operation.

3.4 FORMS

A. Forms shall be securely staked, braced and held firmly to the required line and grade and shall be sufficiently tight to prevent leakage of mortar. All forms shall be cleaned and oiled or wetted before concrete is placed against them.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Complete and approve formwork. Remove debris and foreign material from interior of forms before start of concrete placing.

D. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

E. The maximum cross slope for sidewalks shall be 2.0 percent, sloped towards the gutter. Verify formwork prior to concrete placement. Make corrections as required and bring discrepancies to attention of Engineer.

3.5 JOINTS

A. Locate joints as located on the Drawings, as shown on Engineer-approved joint plan. Conform with applicable sections of ACI 224.3R.

B. Construction Joints: Effected at the end of a pour, lift, or at the end of a day's concrete placement. This type of joint is a plane surface between two distinct sections of concrete.

1. Construction Joints shall be ½ inch wide and full-depth of slab.

2. Joint filler: Unless otherwise specified, Construction Joints shall be constructed with joint filler. Joint filler shall extend the full depth of the slab and shall extend the full length of the joint. Use of multiple pieces of joint material of lesser dimensions to make up required depth and width of joint will not be permitted.

3. Where joints are to receive filler, recess joint filler 1/4-inch below finish surface or as otherwise indicated on the Drawings.

4. Where called-for on the Drawings, install dowels at Construction Joints.

C. Isolation Joints: Installed at intersections of structures on any type including but not limited to buildings, walks with steps, pre-cast concrete curb, light foundations, walls, pads, slabs at footings, or other structures. Isolation Joints shall not be required where concrete flatwork abuts granite curbing.

1. Isolation Joints shall be ½ inch wide.

2. Joint Filler: All Isolation Joints shall be constructed with joint filler. Joint filler shall extend the full depth of the slab and shall extend the full length of the joint. Use of multiple pieces of joint material of lesser dimensions to make up required depth and width of joint will not be permitted.

3. Where joints are to receive filler, recess joint filler 1/4-inch below finish surface or as otherwise indicated on the Drawings.

D. Control/Contraction Joints: Installed to form a weakened plane in a concrete member to provide a reduction in member thickness for the purpose of controlling shrinkage stresses to that specific area. Control/Contraction Joints shall be synonymous with "Dummy Joints."

1. Control/Contraction Joints shall be tooled or saw-cut.

a. Tooled joints: Tool-form joint into the concrete 1 inch in depth, but in no case less than 25 percent of slab depth. Joint width shall be 1/4-inch. Each side of tooled joint shall be dressed to match final overall slab finish. Joint shall be made after concrete is finished and when the surface is stiff enough to support the weight of workmen without damage to the slab, but before the slab has achieved its final set.

1) Where tooled joints are to receive joint sealant, provide 1/2-inch wide tooled joint and install backer rod material to create 1/4-inch recess below finished surface.

b. Saw-cut joints: Saw-cut joint into concrete 1 inch in depth, but in no case less than 25 percent of slab depth. Joint width shall be 1/8-inch. Cut joint using rotary saw within 4 to 12 hours after the concrete has been finished.

3.6 STEEL REINFORCEMENT

A. Install steel reinforcement as shown on the Drawings in accordance with ACI 318.

B. Before being placed in position, reinforcing shall be thoroughly cleaned of loose mill and rust scale, dirt, ice, and other foreign material, which may reduce the bond between the concrete and reinforcing. Where there is a delay in placing concrete after reinforcement is in place, reinforcement shall be re-inspected and cleaned when necessary.

C. Welded Wire Reinforcement

1. Where WWR is called-for, install material in the upper 30 to 40 percent (30%–40%) of the overall slab thickness, or at the nearest depth below top of slab as required to achieve a minimum of 2-inches of cover.

2. Adjacent sheets of welded wire reinforcement shall lap 6 inches.

D. Reinforcing bar

1. Any bar showing cracks after bending shall be discarded.

2. Minimum Cover: 2 inches, except where concrete is cast against and permanently exposed to earth minimum cover shall be 3 inches.

3. For slab-type construction, reinforcing bars shall be elevated off the base material by use of supports as specified herein.

4. Adjacent reinforcement bars shall lap a distance equivalent to 40 bar diameters. All laps shall be tied.

E. Joints

1. Construction Joints: Reinforcement shall not continue through construction joints. Allow for 2-inches of cover at end of slab. Where called-for on the Drawings, install pins at Construction Joints per detail.

2. Isolation Joints/Expansion Joints: Allow for 2-inches of cover at end of slab.

3. Control/Contraction Joints: Cut at least one-half of reinforcement at joints.

F. Reinforcing shall be securely wired in the position called for, and shall be maintained in that position until concrete is placed and compacted.

3.7 PLACEMENT

A. Before placing concrete, forms and the space to be occupied by the concrete shall be thoroughly cleaned, and reinforcing steel and embedded metal shall be free from dirt, oil, mill scale, loose rust, paint, and other material which might tend to reduce bond.

B. Existing concrete, earth, forms, and other water-permeable material against which new concrete is to be placed and shall be thoroughly damp when concrete is placed. There shall be no free water on the surface.

C. Concrete shall arrive at the job site in a timely manner so that no additional water will be required to produce the desired slump. When conditions develop that require the addition of water to produce the desired slump, permission of the Engineer must be obtained. The concrete shall be transported from the mixer to its place of deposit by a method that will prevent segregation or loss of material.

D. Concrete, which has set, or partially set, before placement shall not be employed.

E. Existing concrete, earth, and other water-permeable material against which new concrete is to be placed shall be thoroughly damp when concrete is placed. There shall be no free water on surface.

F. Concrete shall be thoroughly spaded and tamped to secure a solid and homogeneous mass, thoroughly worked around reinforcement and into corners of forms.

G. When joining fresh concrete to concrete which has attained full set, the latter shall be cleaned of foreign matter, and mortar scum and laitance shall be removed by chipping and washing. Clean, roughened base surface shall be saturated with water, but shall have no free water on surface. A coat of 1:1 cement-sand grout, approximately 1/8-inch thick shall be well scrubbed into thoroughly dampened concrete base. New concrete shall be placed immediately, before grout has dried or set.

3.8 FINISHING

A. Concrete flatwork surfaces shall be screened off and finished true to line and grade, and free of hollows and bumps. Surface shall be dense, smooth, and at exact level and slope required.

1. Finished concrete surface for concrete subbase shall be woodfloated to a slightly rough surface. Surface shall not deviate more than 1/4-inch in 10 feet.

2. Finished concrete surface for concrete pavement, walks, and pads shall be wood-floated and steel troweled to a smooth surface. Surface shall not deviate more than 1/8-inch in 10 feet.

B. Unless otherwise indicated, horizontal surfaces of concrete surfaces, which will be exposed, shall be given a light broomed finish, with direction of grooves in concrete surface perpendicular to length of concrete band, slab or pad. After concrete has set sufficiently to prevent coarse aggregate from being torn from the surface, but before it has completely set, brooms shall be drawn across it to produce a pattern of small parallel grooves. Broomed surface shall be uniform, with no smooth, unduly rough or porous spots, or other irregularities. Coarse aggregate shall not be dislodged by the brooming operation.

C. Immediately following finishing operations, arises at edges and both sides of expansion joints shall be rounded to a ¼ inch radius. Control joints to be tooled shall be scored into slab surface with scoring tool. Adjacent edges of control joint shall be same time be finished to a ¼ inch radius.

D. Where finishing is performed before the end of the curing period, concrete shall not be permitted to dry out, and shall be kept continuously moist from time of placing until end of curing period, or until curing membrane is applied.

3.9 CURING

A. Cure in accordance with ACI 308R.

B. Concrete shall be kept continuously damp from time of placement until the end of the specified curing period.

C. Water shall not be applied to curing concrete within 24 hours after initial placement. Any water shall be applied only to maintain damp conditions. Do not add water during floating and troweling operations.

D. Between finishing operations, the surface shall be protected from rapid drying by covering with a material specified herein. Surface shall be damp when the covering is placed over it, and shall be kept damp by means of fine-spray of water, applied as often as necessary to prevent drying after the initial 24-hour cure period.

E. Concrete surfaces shall be cured by completely covering them with curing paper or an application of a curing compound.

1. Concrete cured using waterproof paper shall be completely covered with paper with seams lapped and sealed with tape. Concrete surface shall not be allowed to become moistened between 24 and 36 hours after placing concrete. During curing period surface shall be checked frequently, and sprayed with water as often as necessary to prevent drying, but not earlier than 24 hours after placing concrete.

2. If concrete is cured with a curing compound, the compound shall be applied at a rate of 200 square feet per gallon, in two applications perpendicular to each other.

3. Curing period shall be seven days minimum. Full-strength shall be considered after 28 days.

F. Only if additional protection is required, the surface should remain uncovered for at least 4 days, after which time new and unwrinkled non-staining reinforced waterproof Kraft curing paper may be used.

3.10 COLD WEATHER CONCRETING

A. Comply with ACI 306R Guide to Cold Weather Concreting.

B. Materials for concrete shall be heated for concrete, which is mixed, placed or cured when the mean daily temperature is below 40 degrees F or is expected to fall below 40 degrees F within 72 hours. The concrete, after placement, shall be protected by covering, heat, or both.

C. Details of handling and protecting concrete during freezing weather shall be subject to the approval of Engineer.

3.11 HOT WEATHER CONCRETING

A. Comply with ACI 305R: Guide to Hot Weather Concreting.

B. Concrete just placed shall be protected from the direct rays of the sun and the forms and reinforcement just prior to placement shall be sprinkled with cold water. Every effort shall be made to minimize delays that will result in excessive mixing of the concrete after arrival on the job.

C. During periods of excessively hot weather (95□F, or above), ingredients in the concrete shall be cooled insofar as possible and cold mixing water shall be used to maintain the temperature of the concrete at permissible levels all in accordance with the provisions of ACI 305R. Any concrete with a temperature below 95□F, when ready for placement, will not be acceptable, and will be rejected.

D. Temperature records shall be maintained throughout the period of hot weather giving air temperature, general weather conditions (calm, windy, clear, cloudy, etc.) and relative humidity. Records shall include checks on temperature of concrete as delivered and after placing in forms. Data should be correlated with the progress of the Work so that conditions surrounding the construction of any part of the structure can be ascertained.

3.12 PROTECTION

A. Concrete surface shall be protected from traffic or damage until surfaces have hardened sufficiently. If necessary, ½ inch thick plywood sheets shall be used to protect the exposed surface.

3.13 CLEAN UP

A. Remove all debris, residuals, and materials at the conclusion of the work. Dispose of all materials in accordance with applicable waste management regulations.

3.14 SEALANT

A. Apply concrete sealer to sidewalks, ramps, steps, and pads after cure period in accordance with manufacture's guidelines.

END OF SECTION

DIVISION 05
METALS

SECTION 05 5200

METAL RAILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnishing and installing steel pipe guard rails and hand-rails at ramps, steps, and other location indicated on the Drawings.

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCE STANDARDS

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. ASTM International (ASTM).

1. ASTM A36 - Specification for Structural Steel.

2. ASTM A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A143 - Recommended Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

4. ASTM A153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

5. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

6. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

7. ASTM A384 Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.

8. ASTM A385 - Practice for Providing High-Quality Zinc Coatings (Hot-Dip).

9. ASTM A449 - Specification for Quenched and Tempered Steel Bolts and Studs.

10. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

11. ASTM A563 - Specification for Carbon and Alloy Steel Nuts.

12. ASTM A780 - Practice for Repair of Damaged Hot-Dip Galvanized Coatings.

13. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

14. ASTM D1640 - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature.

15. ASTM D2092 - Practices for Preparation of Zinc-Coated Galvanized Steel Surfaces for Paint.

D. National Association of Architectural Metal Manufacturers (NAAMM).

1. “Pipe Railing Manual, Including Round Tube"

E. Society of Automotive Engineers (SAE)

1. Standard J404 200901, Chemical Compositions of SAE Alloy Steels.

F. State of Connecticut

1. State Building Code, including all Amendments, Supplements, and Errata.

G. American Welding Society

1. D1.1/D1.1M:2006, Structural Welding Code - Steel

H. Master Painters Institute (MPI)

I. Steel Structures Painting Council (SSPC).

1. SSPC-SP 1 Solvent Cleaning.

2. SSPC-SP 3 Power Tool Cleaning.

3. SSPC-SP 10 Near-White Blast Cleaning.

4. SSPC-SP 11 Power Tool Cleaning to Bare Metal.

1.3 SYSTEM DESCRIPTION

A. Provide guardrail and railing systems as indicated on the Drawings as complete systems in accordance with design intent, actual site conditions, and State Building Code.

B. Performance Requirements

1. Structural Performance: Railings shall withstand all loads as required by State Building Code.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. Shop Drawings

1. Submit shop drawings of metal guardrails, handrails, and railings, showing sizes, details of fabrication and construction, bends and radii, handrail brackets, locations of hardware, anchors, and accessories, and installation details. Shop Drawings shall be submitted to Engineer for approval prior to ordering materials.

2. Submit manufacturers' product data of railing system and railing components, handrails, and handrail brackets. Include corrosion-inhibitive shop coat painting system.

1.5 QUALITY ASSURANCE

A. General: Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.

B. Installer Qualifications: Minimum of 3 years of experience on similar type projects / work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Contractors failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.

C. Source Limitations: Obtain each type of handrail and railing through one source from a single manufacturer. Railing materials must be supplied in consistent quality in appearance and physical properties.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage

1. Transportation carrier shall use appropriate methods to ensure materials are properly packaged, stacked, and restrained during transport. Utilize protective packaging as required.

2. Protect materials during storage against moisture, soiling, staining, and physical damage.

3. Any railing or associated component showing manufacturing flaws upon receipt at the Project Site shall be referred to Engineer for determination as to whether it shall be repaired, rejected, or used.

4. Protect railing materials during storage to avoid damage from moisture, abrasion, and other construction activities.

B. Handling

1. Handle railing materials to prevent abrasion, chipping, marring, soiling and other damage.

2. Damaged equipment shall not be installed. Contractor shall bear responsibility for damage to equipment until final acceptance by Owner. Any installed equipment exhibiting damage shall be replaced or repaired to the satisfaction of Engineer, and Contractor shall assume all costs related thereto.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating handrails and railings without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.9 SCHEDULING

A. Schedule installation so handrails and railings are mounted only on completed walls or associated with concrete stem wall installation / pour. Do not support temporarily by any means that does not satisfy structural performance requirements.

PART 2 PRODUCTS

2.1 STEEL TUBING HANDRAIL

A. Steel Pipe, seamless, ASTM A500, Grade C, “Standard Weight” railing (Schedule 40), unless another grade and weight are required by structural loads. Diameter and dimensions as indicated on the Drawings. Special instructions shall be given the pipe manufacturer to provide “Architectural Handrail Grade Pipe”.

2.2 FITTINGS, BRACKETS, AND PLATES

A. Fittings, Brackets, Flanges, and Plates: Cast or formed metal of the same type of material and finish as rails unless otherwise indicated.

B. Steel: Galvanized malleable iron, manufactured for the purpose, for anchorage to concrete.

C. Stainless Steel: 304 or 316 stainless steel to match finish. Stainless steel fittings shall be used in all applications where stainless steel railings are called-for.

D. Plates: Steel plate shall be standard steel plate, ASTM A36, weldable quality.

2.3 ANCHORS, FASTENERS, AND ACCESSORIES

A. Provide all required anchors, fasteners, miscellaneous components, and accessories as required for complete and finished railing installations.

1. Bolts and studs, nuts, and washers: ASTM A307, A449, and A563, as applicable.

2. Galvanizing: ASTM A153.

B. Expansion Bolts: Where anchors are not included in the concrete construction, provide galvanized expansion type anchors with matching galvanized steel bolts or studs with nuts, of sizes as indicated or required. Provide washers under all bolt heads and nuts. Expansion bolts require approval of Engineer before they may be installed in post-tensioned slabs. Expansion bolts will not be permitted for use on concrete curbs or along the edge of concrete or a concrete joint.

2.4 FABRICATION

A. Rails

1. Metal handrails and railings shall be fabricated by firms or shops experienced and skilled in the custom fabrication of architectural metal handrails and railings, and shall meet the quality requirements of NAAMM's Pipe Railing Manual.

2. Bends in rails shall be precision-formed to a smooth continuous radius by skilled workers. Work quality and finish shall be true to detail. Butt joints shall have internal pipe sleeve or dowel. Ends shall be closed with similar materials, welded and ground smooth.

3. Steel welded connections shall be made in accordance with applicable requirements of the AWS Structural Welding Code. Welding shall be performed in the shop unless otherwise indicated. Welded joints of handrails and railings shall be ground and dressed smooth to match adjacent surfaces and so that the shape and profile of the item welded is maintained.

4. Metal handrails and railings shall be prefabricated and preassembled in the factory or shop as far as practicable.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form work true to line and level with accurate angles and surfaces.

D. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

E. Form changes in direction by bending or by inserting prefabricated elbow fittings.

F. Bend members in jigs to produce uniform curvature without buckling or otherwise deforming exposed surfaces.

G. Close exposed ends of railing members with prefabricated end fittings.

H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

2.5 GALVANIZING

A. Ferrous metal railings and related items on the exterior of the building, or as otherwise indicated, shall be galvanized, after fabrication, by the hot-dip process in accordance with ASTM A123 and ASTM A385. Weight of zinc coating shall conform with requirements specified under "Weight of Coating" in ASTM A123.

B. Safeguarding against steel embrittlement: conform with applicable requirements of ASTM A143.

C. Safeguarding against warpage and distortion of steel members: conform with applicable requirements of ASTM A384.

D. Shop galvanized metalwork necessitating field welding which in any manner removes original galvanizing shall be restored by galvanizing repair in accordance with ASTM A780.

E. Bolts and screws for attachment of galvanized items shall be galvanized in accordance with ASTM A153, or of compatible, non-corrodable material.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railings.

E. Primer

1. Etch Primer: For galvanized surfaces, utilize etch primer, MPI #25, to roughen and dull the surface. Allow surface to dry 24 hours minimum, then prime.

2. Waterborne primer, acrylic or modified acrylic, suitable for use on exterior galvanized metal surfaces.

3. Drying time. Dry-to-touch time shall be a maximum of one hour, and the dry-to-recoat time shall be a maximum of 4 hours when tested in accordance with ASTM D 1640.

F. Paint

1. Waterborne paint, acrylic or modified acrylic, suitable for use on exterior metal surfaces.

2. Color: As indicated on the Drawings.

3. Drying time. Dry-to-touch time shall be a maximum of one hour, and the dry-to-recoat time shall be a maximum of 4 hours when tested in accordance with ASTM D 1640.

2.7 GROUT AND ANCHORING CEMENT

A. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout, ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Interior Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.

C. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

PART 3 EXECUTION

3.1 GENERAL

A. Install metal handrails and railings as indicated and in accordance with the approved Shop Drawings, using workers skilled and experienced in the installation of the type of work involved. Conform with installation requirements of NAAMM's Pipe Railing Manual, as applicable.

B. Install metal handrails and railings with accessories furnished by the railing fabricator as required for complete and finished railing installations. The rail elements shall be erected to produce a smooth, continuous rail.

C. Installation of handrails and railings shall be in accordance with approved Shop Drawings, true and horizontal, perpendicular, or at the required angle, as the case may be, level and square, with angles and edges parallel with related lines of the building or structure. Include all fittings and components, sleeves, hardware, backing plates, and accessories as required for complete and finished handrail installations.

D. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

3.2 INSTALLATION

A. Concrete Mounting

1. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

2. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

3. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

4. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

5. Anchor posts in concrete by inserting into formed or core-drilled holes and grouting annular space.

B. Wall Mounting

1. Attach railings to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

2. Secure wall brackets and railing end flanges to building construction as follows:

a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

b. For hollow masonry anchorage, use toggle bolts.

c. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs.

C. Coordinate with stud installation to locate backing members.

3.3 GALVANIZING REPAIR

A. Repair galvanized surfaces which have become damaged from welding, handling, or installation immediately after installation in accordance with ASTM A780.

3.4 CLEANING AND PAINTING

A. Clean galvanized railings in accordance with ASTM D2092.

B. Prior to site surface preparation and coating applications, remove, mask, or otherwise protect, finished work, hardware, hardware accessories, and other such items not to be coated. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

C. All surfaces of metal handrails and railings shall be cleaned and treated to assure maximum paint adherence, prior to application of the shop prime coat, in accordance with SSPC-SP 1, SSPC-SP 3, SSPC-SP 10, SSPC-SP 11 as applicable for the type of substrate, exposure, and application.

D. Ferrous metalwork shall be given a shop coat of rust-inhibitive metal primer, or other approved rust-inhibitive metal primer standard with the railing manufacturer.

E. After installation, exposed painted surfaces, field welds, and other abraded or damaged primed surfaces shall be prepared as required and touched up with an additional coat of the same primers for ferrous and galvanized surfaces as hereinbefore specified for shop painting.

F. Lightly sand and feather out such damaged surfaces so that paint touch-up becomes invisible.

3.5 ADJUSTING AND CLEANING

A. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

END OF SECTION

DIVISION 11
EQUIPMENT

SECTION 11 6800

PLAY FIELD EQUIPMENT AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Purchase, delivery and installation of all fixed play field equipment and components.

2. Purchase and delivery of all non-fixed play field equipment and components.

1.2 REFERENCES

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. ASTM International (ASTM).

1. ASTM F 2950 – Standard Safety and Performance Specification for Soccer Goals.

2. ASTM F 1938-98 – Standard Guide for Safer Use of Movable Soccer Goals.

D. Connecticut Interscholastic Athletic Association (CTIAA).

E. National Collegiate Athletic Association (NCAA).

F. National Federation of State High Schools (NFSH)

1.3 SUBMITTALS

A. Manufacturers Product Data

1. Provide manufacturers product data prior to actual field installation work, for Engineer's and Owner's representatives review.

2. Material safety data sheets on all products, as necessary.

B. Shop Drawings

Provide drawings of the manufacturers recommended installation and foundation requirements signed and sealed by an Engineered licensed in the State of Connecticut prior to actual field installation work for project records.

1.4 QUALITY ASSURANCE

A. Manufacturers warranties shall pass to the Owner and certification made that the product materials meet all applicable grade trademarks or conform to industry standards and inspection requirements.

1.5 PRODUCT DELIVERY AND STORAGE

A. Materials delivered to the site shall be examined for damage or defects in shipping. Any defects shall be noted and reported to the Owners representative. Replacements, if necessary, shall be immediately re-ordered, so as to minimize any conflict with the construction schedule. Sound materials shall be stored above ground under protective cover or indoors so as to provide proper protection.

PART 2 PRODUCTS

2.1 SPORTS FIELD EQUIPMENT

A. Furnish all sports field components as specified by these specifications and shown on the project drawings.

B. Color: As selected by Engineer based on all options available from manufacturer.

C. Sports field equipment shall be provided with all necessary components and attachments to fully install, anchor, and complete the systems. Attachment systems shall be in a color approved by the Owner and Engineer. The products shall meet the NFHS regulations.

2.2 FOOTBALL GOAL POSTS

A. Football goal posts shall be all aluminum single support post, rotating, 8-foot offset goose-neck type posts as manufactured by Sports Field Specialties, Inc., Gill, SportsEdge, or approved equal.

B. Components:

1. Single Gooseneck Support, Fabricated of 6" Schedule 40 Aluminum Pipe (6.625" O.D.), 5' Radius, 8' Offset,

2. Rotating Base Plate Mounting Style

3. Crossbar: Fabricated of 6” Schedule 40 Aluminum Pipe (6.625” O.D.)

4. Length: 23’-4” – High School

a. Allowing for the adjustment of both the gooseneck/crossbar and upright/crossbar connections throughout the life of the football goal post ensuring proper alignment of all components.

b. No exposed hardware on the face of the goal.

c. Anti-vibration enhancements such as serrated washers and nyloc coated bolt ends.

C. Uprights: Fabricated of Extruded 6061-T6 Aluminum Tube (4"O.D.) with Rigid Wire Loop Welded to Upper End

1. Length: 20’

D. Finish: Powder Coat Yellow

E. Installation Package Consisting of the Following Components:

1. Rotating Base Plate Mounting Kit
2. Access Frame Kit + : 1/8" (0.125")
3. Aluminum Construction with Gasket Seal
4. 1" PVC Drain Stub,
5. Dimensions: 1'-2 1/2" H X 3'-4" Square
6. Two (2) Half Moon Filler Plugs
7. One (1) Full Size Blank Filler Plug

F. Goal posts shall be supplied with wind directional flags.

1. Each post shall include a package of ten (10) additional shear-pins and two (2) directional flags.

G. Provide shop drawing of football goal post foundation.

2.3 GOAL POST PADDING SYSTEM

A. Goal post pads shall be as manufactured by UCS, Inc., Aluminum Athletic Equipment, Sports Field Specialties, Inc, Gill, Sports Edge, or approved equal. Pads shall be a 6’ in height, 6” thick split cylindrical urethane foam core fully encapsulated in a vinyl laminated polyester fabric to repel water, rot, mildew, UV light and shall further resist tears and abrasions that has a minimum weight of 19 oz per square yard. It shall have hook and loop closure strips and top and bottom tie cords to keep pads in place. Cover material shall be flame retardant.

B. Color: Navy, as selected by Engineer and Owner from manufacturer’s standard colors.

2.4 FOOTBALL EQUIPMENT

A. Provide to the Owner: Football pylons shall be weighted pylons 4” square by 18” in height as manufactured by Sports Filed Specialties, Inc, Aluminum Athletic Equipment, Inc., UCS, Inc., SportsEdge, or approved equal.

1. Posts shall be orange in color and meet the requirements of NFHS rules and regulations.
2. Provide (8) eight pylons.

B. Provide to the Owner: Complete sideline marker set. Durable self-standing marker with 16" x 16" yardline display. Breaks down to store flat. Numbered on both sides. Heavy Duty PVC cover with safe foam core. Weighted bottom. Complete set for both sides of field to include G and all 10 yard markers.

C. Provide to the Owner: 8’ Chain Set and field marker. Completely padded for safety, bright orange and plated chain with swivel hooks.

D. Provide to the Owner: Flip Down Indicator. Completely padded for safety and two color numbers.

2.5 SOCCER GOALS

A. Soccer goals shall be synthetic turf type (without ground sleeves) precision-crafted, official size (24' wide, 8' high, 4' top and 8' bottom depths) soccer goals engineered from aluminum alloys for maximum durability.

B. The main frame is fabricated of 4" square stock slotted heavy-wall aluminum extrusion.. Goals shall be Sports Field Specialties SG824S, AAE SGR-P, Kwik Goal Evolution 3.1 or approved equal.

C. Goals shall include large loop stays and ground bar made of 2" sq. slotted heavy-wall aluminum extrusion with rounded safety corners. The crossbar and ground bar each shall be a one-piece design (no horizontal joints) for added stability.

D. Nets shall be suitable for synthetic turf applications and operate safely without ground sleeves.

1. 5mm braided, knotless, high tenacity, polypropylene soccer net with rope bound perimeter and 4” square mesh.

E. An anchoring system to the football goal post shall be provide. Weighted sand bags are not acceptable.

F. The slotted aluminum extrusions shall be designed to accept two different Net Attachment Systems. Molded Net Clips, and VNS Vinyl Net Strips.

G. Goals shall be equipped with mobility kit. Side mounted wheels are not acceptable.

H. Finish; Powder coat, color: white

I. Provide two complete sets containing two nets each.

J. Provide one (1) complete set of goals, two (2) goals.

2.6 INTERNATIONAL CORNER FLAGS

A. 63" tall x 1" O.D. PVC upright, Steel spring base with weighted base for synthetic turf.

B. Provide a set of (4) four flags.

2.7 TRACK PROTECTION MATS

A. Provide two (2) 15’ wide removable, weighted running track protection mats long enough to cover full crossing of track at players gate.

B. Provide two (2) 12’ wide minimum x 75’ long sideline running track protection mats to cover track from player benches and players during games.

C. Running track protective mat shall guarantee protection of all-weather track to ensure the warranty is not violated for:

1. Team benches
2. Player crossings and cleats
3. Traffic during games

D. Materials:

1. Durable non-woven polypropylene geotextile
2. 19oz. reinforced vinyl wrapped galvanized steel chain perimeter.

E. Track protective mat shall be slip resistant.

F. Colors to be selected by Engineer and Owner from manufacturer's standard colors.

2.8 LONG JUMP/TRIPLE JUMP COVER

A. Provide one (1) sand pit cover for each long/triple jump sand pit.

B. Materials:

1. 19oz. heavy coated solid vinyl.
2. 19oz. reinforced vinyl wrapped galvanized steel chain perimeter.

C. Colors to be selected by Engineer and Owner from manufacturer's standard colors.

D. Covers shall be of sufficient size to completely cover each pit and extend 2' beyond edge.

2.9 LACROSSE GOALS

A. Lacrosse goals shall be synthetic turf type (without ground sleeves) precision-crafted, official size (6' wide, 6' high, 7' depth) lacrosse goals shall be engineered from hi-tech aluminum alloys for maximum durability. Goals shall be Sports Field Specialties LCG, Kwik Goal 2E201 or approved equal. Provide one (1) set of goals.

B. The main frame is welded, one piece top crossbar and uprights of 1-1/2 inch schedule 40 steel pipe (1.9" O.D.) with welded 3/8" diameter netting attachment railing system.

1. Finish: Powder Coat
2. Color: Orange

C. Ground bar: Fabricated from 3/8 inch by 4 inch steel flat bar with holes for net attachment.

D. Nets shall be suitable for synthetic grass applications and operate safely without ground sleeves.

1. 6mm braided, knotless, white nylon net. A weighting system shall be provided to anchor the ground bars to the turf.

2.10 LACROSSE FIELD PYLONS

A. Lacrosse pylons shall be synthetic turf type (without ground sleeves) precision-crafted, official size NFHS lacrosse and weighted. Orange in color.

B. One complete set for Men's Lacrosse.

C. One complete set for Women's Lacrosse.

2.11 FIELD HOCKEY GOALS

A. Field Hockey Goal shall be synthetic turf type (without ground sleeves) one-piece welded aluminum construction with safe, smooth radius corners and powder coated white. Corners shall be reinforced welded for strength and durability. Goals shall be as supplied by Sports Field Specialties FHG or KwikGoal model #2F501, or approved equal.

1. Goals shall include 18'' high polyethylene bottom boards (black)

2. one (1) nylon, 2.5mm twisted polyethylene net (black) with clips

3. Provide external wheel kit.

2.12 HIGH JUMP MAT, BAR, AND STANDARDS

A. Provide one (1) complete set of high jump standards, mat, and bar to meet NFHS specifications. High jump components shall be as supplied by Gill Athletics model # VP410, Sports Field Specialties model HJ1810, or approved equal.

B. Set to include 16'6'' x 10'' x 26''jump landing system pads with safety cutout and hook & loop system, pad cover, one (1) pair of high school regulation standards, and crossbar.

2.13 POLE VAULT BOX, BAR, PADS AND STANDARDS

A. Provide one (1) complete set of pole vault standards, mats and bar to meet NFHS specifications. Pole vault components shall be as supplied by Sportsfield Specialties model TFPV2021H JumpZone or approved equal.

1. Base Pads: Base sections constructed of 19oz. heavy coated vinyl polyester scrim exterior with high tear and tensile strength with inner polyurethane foam core.

   a. Vinyl seams double stitched with 6 pound bonded polyester thread.

   b. Adjustable nylon straps with buckles and 8 inch hook and loop attachment.

   c. 2" wide nylon web transport handles.

   d. Stainless steel snap hooks, buckles, and "D" rings

2. Top Pad: 2" thick foam covered with heavy duty vinyl coated polyester mesh that is UV and spike resistant.

3. Standard removable 8' x 10' white mesh secured with hook and loop.

4. Pole vault planting box safety collar pad, 2" thick high-density polyurethane foam and yellow vinyl.

5. 19oz. heavy coated vinyl polyester scrim all weather covers and ground covers.

B. Vault Box: Provide one (1) complete pole vault box with to meet NFHS specifications. Pole vault box shall be as supplied by Sportsfield Specialties model TFPV001CA-W or approved equal.

1. Cast aluminum pole vault box with side wings to secure in concrete.

2. Powder coat finish. Color: White

3. 8” wide reverse bend at box entry area.

C. Vault Box Cover: 1/8 inch thick aluminum with ½ inch recess to receive synthetic track surfacing material.

2.14 DISCUS CAGE

A. Provide one (1) complete discuss cage system that meets NFHS specifications. Discuss cage components shall be as supplied by Sportsfield Specialties model TFDCHS or approved equal.

B. Upright poles shall be fabricated of 4 inch O.D. x 1/8 inch thick wall 6061 aluminum tube with 3 feet arced rolled offset, 14 feet above finished grade. Standard aluminum mill finish.

C. Ground Sleeves: Aluminum 4.3 inch O.D., 4.1 inch I.D. aluminum pipe with welded base plate with upright pole alignment bolt and plastic friction fit cap.

D. Net: #36 black nylon, 1 ¾ inch square mesh with rope bound perimeter.

E. Provide required hardware for a complete installation.

2.15 HURDLES

A. Provide twenty (20) powder coated steel or aluminum L-shaped single cross 41’’ hurdles. Adjustable heights to 30’’, 33’’, 36’’, 39’’, and 42’’. Hurdles shall meet the official precise pullover force and weight requirements at all heights as required by the governing rules organizations.

B. Gateboard shall be manufactured from a long lasting white polycarbonate material that can have custom vinyl lettering or logos.

C. Provide two (2) hurdle carts, aluminum construction, 5” diameter hard rubber swivel casters, powder coat black finish with locking tether. Capacity shall be ten (10) hurdles each.

2.16 TEAM BENCHES

A. Provide four (4) 8’ aluminum portable benches with back.

B. Color: Selected bu owner and engineer from manufacturers standard color chart.

2.17 BALL SAFETY NETTING SYSTEM

A. Components:

1. 2" 10' Straight Pole Ball Safety Netting System and Accessories:

2. 2" Schedule 80 Aluminum Pipe (2.375" O.D.), 12’ 8.25” long pole with black powder coated finish.

3. Ground Sleeves:
    a. 2' (24") Ground Sleeve
    b. Aluminum tube with base plate and alignment bolt.
4. Ball Safety System Net:
    a. Overall Dimensions: Refer to Project Drawings.
    b. 1-3/4" Square Mesh.
    c. #36 Black Nylon with sewn ¼" diameter braided rope binding on perimeter edges.
5. Accessories:
    a. Stainless Steel and/or Galvanized Steel Assembly Hardware.
    b. Secure Snap Clips for Net Attachment.
    c. Net Guide Rings.
    d. Black Vinyl Coated Wire Rope, Stainless Steel Wire Rope or Galvanized Steel Wire Rope.
    e. Black Plastic Friction Lock or Aluminum Ground Sleeve Caps.
    f. Model Specific Hardware Kit and Installation Instructions.
    g. Provide one (1) pole and hardware cart with capacity to hold fifty-six (56) poles.

B. Provide shop drawing for sleeve footing.

2.18 FACILITY USE SIGNAGE

A. Facility Use Signage shall be 24" x 42" .063 Aluminum sign. Message shall be applied with durable 7 year vinyl graphics. Sign shall be three color sign. Sign shall be supplied with radius corners and 4 (3/16") mounting holes, Provide and install (8) signs and mounting system.

B. Sign shall include the facility name and the following:

1. No use without a Permit.
2. No alcoholic beverages, juice, sports drinks or soda.
3. No smoking, tobacco products or e-cigarettes.
4. No chewing gum.
5. No dogs or other animals.
6. No unauthorized vehicles or motorcycles.
7. No bicycles, skateboards, roller skates, roller blades or strollers.
8. No sunflower seeds or other foods.

9. No golf.

10. No steel or metal turf cleats on turf surfacing. Use plastic molded cleat athletic shoes with 5 to 11 molded cleats.

11. Do not drag goals or benches on turf or track.

12. The use of flat soled shoes on the synthetic turf is not recommended but allowed.

13. Use only water.

PART 3 EXECUTION

3.1 INSTALLATION OF SPORTS FIELD COMPONENTS

A. Provide all materials and necessary labor for the complete installation of the padding.

B. Install goal posts level, plumb and in proper alignment with the sports field marking.

C. Install pads in accordance with manufacturer’s requirements.

D. Install all bases, plates and rubbers as per manufacturer’s instructions.

E. Mount signs at locations determined by Engineer and Owner.

F. All athletic equipment shall be installed as recommended with manufacturer's written directions, and as indicated on the drawings.

G. Provide drawings of the manufacturers recommended installation and foundation requirements prior to actual field installation work, for Engineer’s review.

END OF SECTION

DIVISION 31
EARTHWORK

P

SECTION 31 2310

EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Preparation and grading subgrades for slabs-on-grade, walks, pavements, and landscaping.

2. Excavating and backfilling for structures.

3. Excavation and backfilling for underground utilities and associated appurtenances.

4. Excavation, backfill and compaction for the demolition/removal of subsurface utilities and improvements.

5. Earth retention systems.

B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 GENERAL

A. Contractor is advised that lines and grades, as shown on the Drawings, are subject to change. Although it is intended to adhere to what is shown on Drawings, Engineer reserves the right to make changes in lines and grades of utilities or other subsurface construction when such changes may be necessary or advantageous.

B. In open trenching on public roadways, Contractor shall be governed by the conditions, restrictions and regulations made by the local or state authority as applicable. All such regulations shall be in addition to those set down in the Specifications.

1.3 EXCAVATION CLASSIFICATIONS

A. Excavation - Excavation shall be unclassified and no consideration will be given to the nature of the materials. Excavation shall comprise and include the satisfactory removal and disposal of all materials encountered regardless of the nature of the materials and shall be understood to include but not limited to earth, fill, boulders, foundations, pavements, curbs, piping, cobbles, stones, footings, bricks, concrete, previously abandoned drainage structures and utility structures abandoned and not removed by the utility and debris.

B. Common Excavation - Excavation of all materials that can be excavated, moved, loaded, transported, and unloaded using heavy equipment or that can be excavated and dumped into place or loaded onto hauling equipment by excavation equipment (shovel, bucket, backhoe, dragline, or clam shell) or moved with dozer-type equipment, appropriate to the material type, character, and nature of the materials. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material. All Common Excavation shall be included in the Base Bid.

C. Rock Excavation - Rock Excavation as defined herein. The excavation and removal of isolated boulders or rock fragments larger than 1 cubic yard encountered in materials otherwise conforming to the definition of Common Excavation shall be classified as rock excavation. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.

1.4 REFERENCES

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

B. State of Connecticut Department of Transportation (ConnDOT)

1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 817, 2016 and any supplements.

C. Code of Federal Regulations (CFR)

1. 29 CFR 1926, Safety and Health Regulations for Construction

D. American Concrete Institute (ACI)

1. ACI 229R-99 - Controlled Low-Strength Materials (CLSM).

E. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO Method T 90 - Determining the Plastic Limit and Plasticity Index of Soils.

2. AASHTO T104 - Standard Method of Test for Soundess of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.

3. AASHTO Method T146 - Standard Method of Test for Wet Preparation of Disturbed Soil Samples for Test.

F. ASTM International (ASTM).

1. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils.

2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3(2,700 kN-m/m3)).

4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

5. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

7. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.5 DEFINITIONS

A. Backfill: Soil material or flowable concrete used to fill an excavation.

B. Bedding Course: Layer placed over the excavated sub-grade in a trench before laying pipe.

C. Benching: A method of limiting cave-in potential by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Clearing: Clearing shall consist in the felling, cutting up, and satisfactory disposal of trees and other vegetation designated for removal in accordance with these specifications.

F. Drainage Course: Layer supporting basement grade used to minimize capillary flow of pore water.

G. Earth Retention Systems: Any structural system, such as sheeting and bracing or cofferdams, designed to retain in-situ soils in place and prevent the collapse of the sides of an excavation in order to protect employees and adjacent structures.

H. Excavation: Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

1. Additional Excavation: Excavation beyond required dimensions or below subgrade elevations that is requested and/or directed by Engineer. Additional Excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.

3. Unauthorized Excavation: Excavation below the elevations specified on the plans, beyond the limits indicated on the plans, or where no dimensions are indicated, beyond depths, elevations, and dimensions reasonably necessary for construction of the work without the request and/or direction of the Engineer. Unauthorized excavation, as well as any remedial work directed by Engineer, or if applicable Geotechnical Engineer, shall be without additional compensation.

I. Fill: Soil materials used to raise existing grades.

J. Finished Grade: The proposed final elevations shown on the Drawings or called for in the Specifications.

K. Geotechnical Engineer: A qualified and licensed entity designated for the project as the authority on the assessment, design, and oversight of soil and/or rock conditions and construction affected by such conditions.

L. Geotechnical Testing Agency: An independent testing agency employed by Owner, or by Contractor is called-for, and qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

M. Grubbing: Grubbing shall consist of the removal of roots 1 ½ inch and larger, organic matter and debris, and stumps having a diameter of three inches or larger, to a depth of at least 18 inches below the surface and or subgrade; whichever is lower, and the disposal thereof.

N. Protective System: A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include earth retention systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

O. Regular Excavation: Removal and disposal of any and all material above subgrade elevation, except solid rock and undercut excavation, located within the limits of construction.

P. Rock: Solid ledges, bedded deposits, unstratified masses and conglomerations of material so firmly cemented as to possess the characteristics of solid rock which cannot be removed without systematic drilling or hoe ramming. All boulders containing a volume of more than one (1) cubic yard shall be considered rock.

Q. Rock Excavation: Removal and satisfactory disposal of Rock, which, in the opinion of Engineer, cannot be excavated except by drilling, wedging, jack hammering or hoe ramming or the excavation of boulders or rock fragments containing a volume of more than one (1) cubic yard. The presence of isolated boulders or rock fragments larger than 1 cubic yard is not in itself sufficient cause to change the classification of the surrounding material.

R. Licensed Professional Engineer: A person who is licensed as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

S. Satisfactory Materials: Earth material that meets the classification, use, and/or gradation requirements herein that does not contain limestone, shale, clay, ash, slag, friable material, organic or vegetative materials, topsoil, wood, trash, broken concrete, masonry rubble, trash, refuse, or frozen materials.

T. Shield System: A structure that is designed to withstand the forces imposed on it by a cave-in and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either pre-manufactured or job-built in accordance with 29 CFR 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

U. Sloping: A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

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

W. Sub-grade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below drainage fill.

X. Surplus Material: Excavated acceptable material that cannot be utilized elsewhere on the site as backfill or embankment fill, or as otherwise directed by the Engineer.

Y. Temporary Dewatering System: A system to lower and control water to maintain stable, undisturbed subgrades at the lowest excavation levels. Dewatering shall be provided for all pipelines, structures and for all other miscellaneous excavations.

Z. Testing Laboratory: A qualified entity engaged to perform specific laboratory tests.

AA. Testing Agency: A qualified entity engaged to collect samples, perform specific in-field tests, and/or inspections. The Testing Laboratory may provide the services of the Testing Agency.

BB. Trench: A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.

CC. Unsatisfactory Material: Soil material that contains organic silt, peat, vegetation, wood or roots, stones or rock fragments over six (6) inches in diameter or exceeding 40 percent by weight of the backfill material, porous biodegradable matter, loose or soft fill, construction debris, or refuse, or material which cannot be compacted to the specified or indicated density.

1.6 SUBMITTALS

A. Testing Laboratory - Submit name and qualifications of commercial testing laboratory for Engineer's approval. Submit applicable documentation of credentials, licenses, etc.

B. Testing Agency - Submit name and qualifications of third-party in-field quality control Testing Agency for Engineer's approval. Submit applicable documentation of credentials, licenses, etc.

C. Site Characterization of Off-Site Borrow Sources: The following information shall be submitted to Engineer for review at least two weeks prior to use of an off-site borrow source:

1. Location and name of the borrow source site.

2. Owner and contact information for the borrow source site.

3. Present and past usage of the source site and materials.

4. Any previously existing report(s) associated with an assessment of the source site as relates to the presence of oils, hazardous materials, or other organic and non-organic constituents which may be considered contaminants.

5. Location within the site from which the material will be obtained.

D. Chemical Testing Data: For each type/classification of earth material proposed and each source of earth material proposed: Submit a letter signed by an authorized representative of material supplier stating that such proposed material is free of oils, hazardous materials, or other organic and non-organic constituents which may be considered contaminants.

E. Material Testing Data: Provide results for all proposed bedding, fill, aggregates, and backfill. Submit complete laboratory reports.

1. Gradation analysis.

2. Soil classification and Moisture-Dry Density Curve.

3. Loss on Abrasion.

4. Soundness.

F. Samples: 50-pound sample of each type of off-site bedding, fill, aggregates, and backfill that are proposed for use at the Project Site in an air-tight container for the testing laboratory, a minimum of two weeks prior to delivery of such material to the site. Use of these proposed materials by Contractor prior to testing and approval or rejection shall be at Contractor's risk.

G. Product Data

1. Plastic warning tape.

2. Separation fabric, filter fabric, geogrids, or similar geotextiles.

H. Field Testing Results

1. Compaction test results keyed to date and specific location of testing. Provide Engineer with copies of testing reports within 24 hours of field test.

1.7 SAFETY

A. Contractor shall conduct all excavation activities in conformance with applicable regulations, including those relating to warning signs, excavation safety, sheeting, shoring, and stabilization.

B. Contractor shall provide and maintain barricades, signs, lights, etc., required for the protection of personnel, materials and property. Temporary barricades, etc. shall conform all applicable codes and regulations, and shall be lighted at night with lanterns, flares and reflectorized paint as required for safety. Adapt barricades, signs, lights, etc. to evolving site conditions throughout the progress of the work.

C. Provide other safety devices as required, including adaptation of such safety devices to changing site conditions, to prevent unauthorized entry to construction areas and open excavations. Provide warning signs and other temporary construction safety devices necessary for proper completion of the work in compliance with applicable safety regulations.

D. Contractor shall properly design and furnish all labor, materials, equipment, and tools necessary to construct permanent or temporary excavation support systems, including, but not necessarily limited to, sheet piling, trench shields, trench boxes, timber trench shoring, pneumatic/hydraulic shoring, steel sheeting or sheeting using other materials, sloping, and benching.

E. Any time an excavation is to remain open, at a minimum, provide full enclosure with safety barriers and fencing, warning signs, and additional safety control measures as appropriate for the condition.

1.8 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required

for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.

B. Utility Mark-out

1. Prior to commencing work, comply with utility mark-out requirements of the Call-Before-You-Dig System (1-800-922-4455).

2. Verify the location of all subsurface utilities marked through the Call-Before-You-Dig System.

3. Not all subsurface facilities or structures will be identified through the Call-Before-You-Dig System. Confirm the location of other subsurface utilities and other subsurface facilities or structures prior to commencing work. Field-mark utilities as required.

C. Codes and Standards: Perform the work of this Section in accordance with all applicable codes, standards, and the requirements of authorities having jurisdiction.

D. Engineer reserves the right to perform all in-field testing specified in this Section and reserves the right to determine the suitability of all materials to be used for fills and reject any fill not meeting the specifications.

E. Field Density testing and subgrade observation shall be performed by the designated entity

F. Weather Limitations:

1. Material excavated when frozen or when air temperature is less than 32 degrees Fahrenheit (32 F) shall not be used as fill or backfill until material completely thaws.

2. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

G. Vibration

1. Vibration producing activities such as operation of heavy construction equipment, vibratory compaction, etc. may be required. Contractor is advised that structures are located close to the proposed work and that construction activities shall be conducted so as to preclude damage to these structures and undue annoyance to occupants.

2. Contractor has liability for, and shall bear all costs associated with, any damage caused to existing structures, buildings and/or services as a result of any construction activity. This extends to responding to any claims of vibration-induced damage. It is Contractor's sole decision how to manage the risk of vibration-induced damage, and what, if any, surveys, monitoring, or other activities are undertaken.

1.9 TESTING

A. All sampling and testing shall be the responsibility of Contractor via Testing Agency and Testing Laboratory as applicable. Contractor shall retain and pay for the services of such Testing Agency/Testing Laboratory to perform all pre-construction testing and field testing in accordance with applicable standards.

B. Borrow and Fill: Contractor shall provide testing as defined below.

1. Gradation analysis for each type of borrow and on-site fill materials by ASTM D422.

2. Soil classification (ASTM D2487) and Moisture-Dry Density Curve (Proctor Test-Modified) by ASTM D1557 for all proposed fill and backfill materials at the frequency specified below:

    a. For suitable soil materials removed during Trench Excavation, perform one test for every 1,000 cubic yards of similar soil type. Similarity of soil types will be as determined by the Engineer.

    b. For borrow materials, perform tests from each proposed source, at a rate of one test for every 1,000 cubic yards of soil type. Similarity of soil types will be as determined by the Engineer.

3. Loss on Abrasion: Where called-for, AASHTO Method T 96.

4. Soundness: Where called-for, AASHTO Method T 104.

C. Compaction Testing: Contractor shall conduct compaction testing (i.e. ASTM D2922 and ASTM D3017 or ASTM D1556) at the frequency indicated below.

1. Trench: 1 test per lift, every 1,000 square feet or 200 feet of trench.

2. Embankment/general backfill: 1 test per lift, every 1,000 square feet.

3. Additional compaction testing may be required when there is evidence of a change in the quality of moisture control or the effectiveness of compaction.

4. If testing indicates that compacted subgrade, backfill, or fill are below specified density, additional compaction and/or replacement of material shall be provided at no expense to Owner.

D. Chemical Testing: Prior to delivery of any earth material to the Project Site, Contractor shall conduct chemical testing to demonstrate that such material is free of oils, hazardous materials, or other organic and non-organic constituents which may be considered contaminants.

1.10 EXCAVATED MATERIAL

A. Placement

1. Excavated material shall be so placed as not to interfere with travel or movement on existing streets, driveways, sidewalks or other areas designated to remain undisturbed. Excavated material shall not be deposited on private property without the written consent of the property owner(s) and approval of Engineer.

2. No excavated material shall be stored on top of installed pipe, other subsurface construction, or within the drip-line of trees.

3. Contractor shall consider surcharge loads when stockpiling excavated material adjacent to excavations, and take any measure required to prevent cave-in, including but not limited to, excavation support systems and/or alternative stockpiling locations.

B. Satisfactory Material excavated at the Project Site may be used for Common Fill or Backfill on other parts of the Work, if specifically approved by Engineer. Engineer or Geotechnical

Engineer shall determine what is Satisfactory Material or Unsatisfactory Material where questions arise.

C. Contractor shall be responsible for the proper disposal of all Unsatisfactory Material. Engineer or Geotechnical Engineer shall determine what is Satisfactory Material or Unsatisfactory Material where questions arise.

1.11 SHEETING, SHORING AND BRACING

A. Provide earth retention systems as required by federal, state and local regulations. Shoring and bracing of trenches and other excavations shall be in accordance with the latest OSHA Standards and interpretations, and all other applicable codes, rules and regulations of federal, state and local authorities.

1.12 DRAINAGE

A. At all times during construction, Contractor shall temporarily provide, place and maintain ample means and devices with which to remove promptly, and dispose of properly, all water entering trenches and other excavations, or water that may flow along or across the site of the Work, and keep said excavations dry until the structures, pipes, and appurtenances to be built therein have been completed to such extent that they will not be damaged. At the conclusion of the work, Contractor shall remove such temporary means and devices.

B. All groundwater which may be found in the trenches and foundation excavations, and any water which may get into them from any cause whatsoever, shall be pumped or bailed out, so that the trench shall be dry during pipe laying and backfilling and during the placement of concrete.

C. All water pumped or drained from the Work shall be managed in accordance with applicable discharge permits, without undue interference with other work or damage to pavements, other surfaces, or property.

1.13 COORDINATION

A. Prior to commencing earthwork operations, meet with representatives of governing authorities, Engineer, testing entity, and other pertinent entities.

1. Review earthwork procedures and responsibilities including Contractor's schedule of operations, scheduling observation and testing procedures and requirements.

2. Notify participants at least three (3) working days prior to convening conference. Record discussions and agreements and furnish copies to each participant.

3. Contractor shall at all times so conduct his work as to insure the least possible inconvenience to the general public and the residents in the vicinity of the work. Fire hydrants on or adjacent to the work shall be kept accessible to firefighting equipment at all times. Temporary provisions shall be made by Contractor to ensure the proper functioning of all gutters, sewer inlets, and drainage ditches, which shall not be obstructed except as approved by Engineer.

B. Benchmark/Monument Protection: Protect and maintain benchmarks, monuments or other established reference points and property corners. If disturbed or destroyed, replace at no cost to Owner.

C. Provide five (5) days advance notice to Engineer and testing entity for any proposed earthwork operation requiring observation and/or testing.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. All materials used in the work of this Section shall be Satisfactory Material, and any material that does not meet this classification shall be considered an Unsatisfactory Material and shall not be used.

B. Unsatisfactory Soils: Soil materials not meeting the requirements for Satisfactory Soils.

1. Unsatisfactory soils also include satisfactory soils not maintained within two (2) percent of optimum moisture content at time of compaction.

2.2 COMMON FILL/ORDINARY BORROW

A. Earth materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GP-GC, SW, SP, and SM that are free of clay and with less than twenty (20) percent of material by weight passing the No. 4 sieve that passes the No. 200 sieve.

B. Common Fill material is subject to the approval of Engineer and may be either material removed from excavations or borrow from off site. It shall have physical properties such that it can be readily spread and after it has been placed and properly compacted, it will form a dense, stable fill.

C. Common Fill shall not be used at locations where use of a specific earth material is called-for.

2.3 BANK RUN GRAVEL

A. Granular material, well graded from fine to coarse, obtained from approved natural deposits and unprocessed, except for the removal of unacceptable material and stones larger than the maximum size permitted.

B. Bank Run Gravel shall be graded as follows:

Gradation of Bank Run Gravel (ConnDOT Grading “C”)

Sieve	Percent Passing by Weight
1 ½”	100
¾”	45-80
¼	25-60
No. 10	15-45
No. 40	5-25
No. 100	0-10
No. 200	0-5

2.4 GRANULAR FILL

A. Broken or crushed stone, gravel, or a mixture thereof.

B. Broken or crushed stone

1. The product resulting from the artificial crushing of rocks, boulders or large cobblestones, substantially all faces of which have resulted from the crushing operation. Broken or crushed stone shall consist of sound, tough, durable stone, reasonably free from soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces.

C. Bank or crushed gravel

1. Sound, tough, durable particles of crushed or uncrushed gravel, free from soft, thin, elongated or laminated pieces and vegetable or other deleterious substances. Crushed gravel shall be the manufactured product resulting from the deliberate mechanical crushing of gravel with at least 50% of the gravel retained on the No. 4 sieve having at least one fractured face.

D. Granular Fill shall be graded as follows:

Gradation of Granular Fill (ConnDOT Grading "A")

Sieve	Percent Passing by Weight
3 ½"	100
1 ½"	55-100
1/4"	25-60
No. 10	15-45
No. 40	5-25
No. 100	0-10
No. 200	0-5

E. Reclaimed material shall not be considered acceptable for use as Granular Fill.

2.5 SCREENED GRAVEL AND CRUSHED STONE

A. Screened gravel, well graded in size from 3/8 inch to 3/4 inch. The gravel shall consist of clean, hard, and durable particles or fragments. Crushed rock of suitable size and grading may be used instead of screened gravel.

B. Screened Gravel shall be graded as follows:

Gradation of Screened Gravel (ConnDOT Gradation No. 6)

Sieve	Percent Passing by Weight
1"	100
3/4"	90-100
1/2"	20-55
3/8"	0-15
No. 4	0-5

2.6 SUBBASE

A. Bank or Crushed Gravel

1. Sound, tough, durable particles of crushed or uncrushed gravel, free from soft, thin, elongated or laminated pieces. It shall be hard and durable enough to resist weathering, traffic abrasion and crushing.

2. Bank or crushed gravel for subbase shall be graded as follows:

Gradation of Bank or Crushed Gravel Subbase (ConnDOT Gradation "B")

Sieve	Percent Passing by Weight
5"	100
3 1/2"	90-100
1 1/2"	55-95
1/4"	25-60
No. 10	15-45
No. 40	5-25
No. 100	0-10
No. 200	0-5

B. Crusher-Run Stone

1. Sound, tough, durable broken stone. It shall be reasonably free from soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces.

2. Loss on Abrasion: The crusher-run stone shall show a loss on abrasion of not more than fifty percent using AASHTO Method T 96.

3. Crusher-run stone shall for subbase shall be graded as follows:

Gradation of Crusher Run Stone Subbase (ConnDOT Gradation "A")

Sieve	Percent Passing by Weight
3 1/2"	100
1 1/2"	55-100
1/4"	25-60
No. 10	15-45
No. 40	5-25
No. 100	0-10
No. 200	0-5

2.7 PROCESSED AGGREGATE BASE

A. Coarse aggregates and fine aggregates shall be combined and mixed by approved methods so that the resulting material shall conform to the following gradation:

Gradation of Processed Aggregate Base

Sieve	Percent Passing by Weight
2 1/2”	100
2”	95-100
3/4”	50-75
1/4”	25-45
No. 40	5-20
No. 100	2-12

B. Coarse Aggregate: Either gravel, broken stone or a combination thereof. When tested by means of the Los Angeles Machine, using AASHTO Method T 96, the coarse aggregate shall not have a loss of more than 50%.

1. If gravel is used for the coarse aggregate, it shall consist of sound, tough, durable particles of crushed or uncrushed gravel or a mixture thereof, free from soft, thin, elongated or laminated pieces, lumps of clay, loam and vegetable or other deleterious substances.

2. If broken stone is used for the coarse aggregate, it shall consist of sound, tough, durable fragments of rock of uniform quality throughout. It shall be free from soft disintegrated pieces, mud, dirt, organic or other injurious material.

3. Soundness for Gravel and Broken Stone: When tested by magnesium sulfate solution for soundness using AASHTO Method T 104, the coarse aggregate shall show a loss of not more than 15% at the end of 5 cycles.

C. Fine Aggregate: Natural sand, stone sand, screenings or any combination thereof. The fine aggregate shall be limited to material 95% of which passes a No. 4 (4.75-mm) sieve having square openings and not more than 8% of which passes a No. 200 (75-μm) sieve. The material shall be free from clay, loam and deleterious materials.

1. Plasticity: When natural sand is used, the fine aggregate shall conform to the following:

a. When the fraction of the dry sample passing the No. 100 mesh sieve is 4% or less by weight (mass), no plastic limit test will be made.

b. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 4% and not greater than 8% by weight (mass), that fraction shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.

c. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 8% by weight (mass), the sample will be washed; and the additional material passing the No. 100 mesh sieve shall be determined by AASHTO Method T 146, except that the No. 100 mesh sieve will be substituted for the No. 40 mesh sieve where the latter is specified in AASHTO Method T 146. The combined materials that passed the No. 100 mesh sieve shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.

2. Plasticity: When screenings or any combination of screenings and natural sand or any combination of stone sand and natural sand are used, the following requirements shall apply:

    a. When the fraction of the dry sample passing the No. 100 mesh sieve is 6% or less by weight (mass), no plastic limit test will be made.

    b. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 6% and not greater than 10% by mass, that fraction shall not have sufficient plasticity to permit the performing of the plastic limit test, using AASHTO Method T 90.

    c. When the fraction of the dry sample passing the No. 100 mesh sieve is greater than 10% by weight (mass), the sample shall be washed; and additional material passing the No. 100 mesh sieve shall be determined by AASHTO Method T 146, except that the No. 100 mesh sieve shall be substituted for the No. 40 mesh sieve where the latter is specified in AASHTO Method T 146. The combined materials that have passed the No. 100 mesh sieve shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.

2.8 BEDDING

A. Slabs on grade

1. Granular Fill unless otherwise indicated.

B. Utilities- Refer to applicable utility Specifications.

1. Unless otherwise indicated, bedding shall consist of screened gravel, maximum size 3/4 inches and minimum size 3/8 inches.

2. Thermoplastic Pipe: Unless otherwise indicated, ASTM D2321, bedding, haunching, and initial backfill material shall be placed in six-inch lifts and be Class IA, IB, or II embedment material unless otherwise approved by Engineer.

3. When clay, wet, soft or silty soil conditions prevail, 3/4-inch crushed stone shall be used for bedding of pipe.

2.9 SAND

A. Sand shall consist of clean, hard, durable, uncoated particles of quartz or other rock. It shall not contain more than 3% of material finer than a #200 sieve.

B. Organic Impurities: Fine aggregate subjected to the colorimetric test shall not produce a color darker than Gardner Color Standard No. 11, using AASHTO T 21. If the fine aggregate fails to meet this requirement, the provisions of AASHTO M 6, Section 5.2, will govern.

C. Sand shall be uniformly graded as follows:

Gradation of Sand

Sieve	Percent Passing by Weight
3/8”	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

D. The above gradation represents the extreme limits which shall determine suitability for use from all sources of supply. The gradation from any one source shall be reasonably uniform and not subject to the extreme percentages of gradation specified above. For the purpose of determining the degree of uniformity, a fineness modulus determination will be made upon representative samples from any source. Fine aggregate from any one source having a variation in fineness modulus greater than 0.20 either way from the fineness modulus of the representative sample will be rejected.

2.10 FLOWABLE CONCRETE FILL/BACKFILL (FLOWFILL)

A. Cementitious material, ACI 229R, comprised of cement, aggregates, fly ash, water, and admixtures, capable of being poured or pumped, self-leveling, self-curing to specified strengths.

B. Excavatable flowfill: Concrete strength shall be liquid enough to flow, be self-leveling and excavatable by hand methods. Unless otherwise specified, excavatable flowfill shall have a minimum 28 day compressive strength of 30 psi, and shall not exceed 100 psi.

C. Non-excavatable flowable: Concrete strength shall be liquid enough to flow and be self-leveling and excavatable by machine equipment. Unless otherwise specified, non-excavatable flowfill shall have a minimum 28-day compressive strength of 125 psi, and shall not exceed 200 psi.

2.11 DETECTABLE WARNING TAPE

A. Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric power lines, electric power conduits and other electric power facilities.

2. Yellow: Gas, oil petroleum products, steam, compressed air, compressed gas and all other hazardous materials.

3. Blue: Water.

4. Orange: Communication lines or cables, including but not limited to telephone, fire signals, cable television, and electronic controls.

5. Green: Storm drainage and sanitary sewer systems, including force mains and other non-hazardous materials.

6. Brown: Chilled Water and Other.

PART 3 EXECUTION

3.1 PREPARATION

A. Notify "Call-Before-You-Dig" to request a utility mark-out for the Project Site prior to any earth disturbance. Provide written confirmation to Engineer that such mark-out has been completed.

B. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any discrepancies or hazardous conditions.

C. Take precautions for preventing injuries to persons or damage to property in or about the work. Protect structures, utilities, sidewalks, pavements and other improvements from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

D. Protect sub-grades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

E. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

F. When excavations are to be made in paved surfaces, the pavement shall be removed so as to provide a clean uniform edge with a minimum disturbance of remaining pavement. Saw cutting the pavement to provide a clean, uniform edge shall unless otherwise indicated.

G. If pavement is removed in large pieces, it shall not be mixed with other excavated material, but shall be disposed of away from the site of the Work before the remainder of the excavation is made.

3.2 CLEARING AND GRUBBING

A. Clear, grub, remove, and dispose of all vegetation and debris within the limits of construction, as designated on the plans or as required by Engineer. Contractor shall remove only those trees and shrubs absolutely necessary to allow for the construction. The work shall also include the preservation from injury of defacement of all vegetation or object designated to remain.

3.3 PROTECTION OF EXISTING FEATURES

A. General

1. Protect all existing improvements from damage unless those improvements are specifically designated for permeant removal, relocation, or temporary removal and replacement.

2. As excavation approaches underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools.

3. Pavements: On paved surfaces to remain, do not use or operate tractors, bulldozers, or other power operated equipment, the treads or wheels of which are so shaped as to cut or

otherwise damage such surfaces. All surfaces, which have been damaged by Contractor's operations, shall be restored to a condition at least equal to that in which they were found immediately prior to the beginning of operations. Suitable materials and methods shall be used for such restoration.

B. Utilities

1. Existing utilities remaining in service, including those remaining in service until after relocation, and relocated utilities shall be protected from damage. Before excavating near any existing utilities, notify the utility owner, coordinate protective work and comply with the utility owners' requirements. Coordinate with respective utility owners/operators as required.

2. Safeguard and protect from damage or movement any existing services, utilities, and utility structures uncovered or encountered which are to remain in service.

3. All utility services shall be supported by suitable means so that the services shall not fail when tamping and settling occurs.

4. Where known utilities are encountered, notify Engineer and document location and type of utility before proceeding with work in such area.

5. When uncharted or incorrectly charted piping or utilities are encountered during excavation, stop work and notify Engineer immediately. Cooperate with the utility owners in maintaining their utilities in operation prior to resuming work.

C. Retaining Structures: Provide bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures necessary to guard against any movement or settlement of existing or new construction, utility systems, paving, or other improvements. Assume responsibility for the strength and adequacy of retaining structures, and for the safety and support of construction, utilities or paving, and for any movement, settlement or damage thereto. Retain the services of a licensed engineer as required to design bracing, shoring, sheeting, sheet piling, underpinning or other retaining structures.

D. Replacement and Relocation

1. In case of damage, Contractor shall notify the appropriate party so that proper steps may be taken to repair any and all damage done. When the Owner does not wish to make the repairs themselves, all damage shall be repaired by Contractor, or, if not promptly done by him, Engineer may have the repairs made at the expense of Contractor.

2. If certain existing structures are encountered that in the opinion of Engineer require temporary or permanent relocation or removal, Engineer may order in writing that Contractor undertake all or part of such work or to assist the Owner in performing such work. For such occurrences, Contractor shall be compensated as applicable, as extra work.

3. In removing existing structures, Contractor shall use care to avoid damage to the material, and Engineer shall include for payment only those new materials, which, in his judgment, are necessary to replace those unavoidably damaged.

4. The structures to which the provisions of the preceding two paragraphs shall apply include structures which (1) are not indicated on the Drawings or otherwise provided for, (2) encroach upon or are encountered near and substantially parallel to the edge of the

excavation, and (3) in the opinion of Engineer will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced. (See Item 3.19, "Sub Surface Obstructions" also).

3.4 DEWATERING

A. Comply with all applicable permit requirements.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrade and from flooding Project site and surrounding area.

C. Protect sub-grades from softening, undermining, washout and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2. Install de-watering system to keep subgrades dry and convey ground water away from excavations.

3.5 EXCAVATION

A. Dust Control: During the progress of the Work, Contractor shall conduct his operations and maintain the area of his activities in order to minimize the creation and dispersion of dust. Refer to Section 01 5714- Temporary Dust Control.

B. Excavate to the exact elevations shown on the plans, or as directed by Engineer. Where no dimensions are indicated, make excavations in such manner, and to such depths, elevations, and dimensions, that will give suitable room for construction of the work indicated on the Drawings. As applicable for utility installations, comply with trench limits shown on the Drawings.

C. Furnish and place all sheeting, bracing, and supports, and render the bottom of the excavation firm and dry, and in all respects, acceptable for construction of the work.

D. If Contractor excavates below the elevations specified on the plans, beyond the limits indicated on the plans, or where no dimensions are indicated, beyond depths, elevations, and dimensions reasonably necessary for construction of the work, Contractor shall bring the excavation back to the proper elevation and/or dimension by backfilling with Suitable Material that is approved by Engineer in accordance with the backfilling provisions specified herein. Engineer, or if applicable Geotechnical Engineer, shall have sole authority in determining the specific composition of such Suitable Material.

1. Any increase in cost resulting from Unauthorized Excavation, including but not necessarily limited to backfilling, haul-off, increasing the size of footings or foundations, testing, schedule impact, or administrative impact shall be at Contractor’s sole expense.

E. If utilities are to be laid in new embankments, or other new fill areas which are more than 12 inches deep below the invert of the pipe, the fill material shall be placed and properly compacted to final grade or to a height of at least 3 feet above the top elevation of the pipe, whichever is the lesser, before laying pipe. Particular care shall be taken to ensure maximum consolidation of material under the pipe location. The pipe trench shall then be excavated as though in undisturbed material.

3.6 TRENCH EXCAVATION

A. In general, trenches shall be excavated to such depth as will provide a cover depth as indicated on the Drawings from finished grade to the top of the pipe barrel. Deeper trenches shall be provided where necessary on account of the conformation of the ground and to permit the alignment of the pipe without undue deflection of joints.

B. Trenches shall be excavated by hand or machinery to the width and depth indicated on the Drawings and specified herein. Depth shall account for thickness of the pipe and thickness of bedding. All loose materials shall be removed from the bottom of the trench so that the bottom of the trench will be in an undisturbed condition.

C. If in the opinion of Engineer, the material at or below the depth to which excavation for structures and pipes would normally be carried is unsuitable for foundation, it shall be removed to such widths and depths as directed and replaced with suitable material.

D. Trench widths shall be 3 feet greater than the nominal inside diameter of pipe for such diameters of 36 inches or less. For diameters greater than 36 inches, the width shall be 4 feet greater than nominal inside diameter. Trench excavation for manholes, catch basins, drop inlets, etc. shall be two (2) feet outside the neat lines of the foundations. These limits may be adjusted for field conditions at the direction of Engineer.

E. Bedding for pipe and utility structures will be as detailed on the Drawings.

3.7 APPROVAL OF SUBGRADE

A. Notify Engineer, and Geotechnical Engineer if applicable, when excavations have reached required subgrade elevation.

B. If Engineer and, if applicable, Geotechnical Engineer determines that Unacceptable Material is present, continue excavation of such Unacceptable Material and replace with approved Satisfactory Materials as directed. The replacement of Unacceptable Material with Satisfactory Materials will be paid for as a change in the work according to applicable provisions of the contract.

C. Protect subgrade from disturbance at all times. Reconstruct sub-grades damaged by freezing temperatures, frost, rain, accumulated water or construction activities, as directed by Engineer. Excavation and replacement with structural fill of any disturbed or softened materials resulting from inadequate preparation, inadequate dewatering, or inadequate protection, shall be at Contractor's sole expense.

3.8 TUNNELING

A. In general, excavation shall be made in open cut from the surface and Contractor shall not be allowed to do any tunneling without obtaining permission from Engineer, and then only according to methods approved by him, and at no additional cost to the Owner. This permission will only be given where a line is to be laid to a point behind the curb, across a paved street, or where, in the opinion of the Engineer, it is necessary to tunnel short sections on account of proximity of adjacent walls, utilities, structures, to avoid important roots of trees or large masses of roots, or to ensure against root damage endangering the life of trees near the pipeline location. Such excavations then can be made in alternate sections of open cut and tunnel, the length of the tunnel sections to be specified by Engineer. These tunnel sections shall be cut underneath

to a wedge with its edge horizontally across the pipe, and backfilled tightly by ramming and tamping from each end.

3.9 FILL AND BACKFILL

A. Fill: Contractor shall remove loam and topsoil, loose vegetable matter, stumps, large roots, etc., from areas upon which embankments will be built or material will be placed as fill to adjust subgrade prior to final grading. The subgrade shall be prepared by forking, furrowing, or plowing such that the first layer of the new material placed thereon, will be well bonded to it.

B. Backfill: Common Fill material may be used as backfill when indicated on the Drawings or when authorized by Engineer (or as applicable Geotechnical Engineer) if Contractor can achieve required minimum dry density after compaction. Backfilling shall be done as promptly as is consistent with non-injury to pipe or structures, but no backfilling shall be done before Engineer (or as applicable Geotechnical Engineer) gives permission.

C. Frozen material shall not be placed in any fill or backfill, nor shall any fill or backfill be placed upon frozen material. Previously frozen material shall be removed, or shall be otherwise treated as required, before new fill or backfill is placed.

D. After the subgrade has been prepared, fill material shall be placed thereon and built up in successive layers not exceeding twelve (12) inches before compaction until it has reached the required elevation.

   1. When gravel fill or other material is used for foundation of structures, it shall be spread in layers of uniform thickness not exceeding six (6) inches before compaction.

E. Upon completion of filling and backfilling, all surplus material shall be removed and surfaces to remain which are affected in any way by the work restored to the condition in which they were before ground was broken. All surplus materials shall become the property of Contractor. If Contractor fails to promptly remove such surplus materials, Engineer may have the same done and charge all associated costs to Contractor, including deduction from payments due.

3.10 BACKFILLING UTILITIES

A. As soon as practical after utility has been placed into bedding and joints properly made, backfilling shall begin, and shall continue without delay.

B. Placement of bedding over pipe prior to placement of backfill shall be as indicated on the Drawings. Hand-place bedding at the sides of the pipe and to the limits indicated on the Drawings over the pipe. Bedding placed over pipe shall be in 6-inch layers, leveled along the length and width of the trench and thoroughly compacted with approved tampers.

C. Install warning tape as indicated o the Drawings unless otherwise specified by the utility owner/operator.

3.11 BACKFILLING AT STRUCTURES

A. No backfill shall be deposited against concrete until the concrete has obtained sufficient strength to withstand the earth pressure placed upon it and in no case less than seven days, nor before carrying out and satisfactorily completing the tests for watertight structures specified elsewhere.

B. Prior to placing backfill, subgrade shall be thoroughly compacted. Soft or loose material evident during compaction shall be removed and replaced with Granular Fill.

C. Fill placed around arches, rigid frames, box culverts and piers shall be deposited on both sides of the structure to approximately the same elevation at the same time. Each layer of backfill shall be spread to a thickness not exceeding 6 inches deep after compaction and shall be thoroughly compacted by the use of power rollers or other motorized vehicular equipment, by tamping with mechanical rammers or vibrators, or by pneumatic tampers. Any equipment not principally manufactured for compaction purposes or which is not in proper working order in all respects shall not be used within the area described above.

D. Bring backfill to sub-grade elevations. Slope backfill at exterior of building to drain water away from building.

3.12 COMPACTION

A. Each layer of fill or backfill material shall be compacted by the use of compaction equipment consisting of rollers, compactors or a combination thereof. Earth-moving and other equipment not specifically manufactured for compaction purposes will not be considered as compaction equipment. At such points as cannot be reached by mobile mechanical equipment, or where such equipment is not permitted, the materials shall be thoroughly compacted by the use of suitable power- driven tampers.

B. Previously placed or new materials shall be moistened by sprinkling, if required, to ensure proper bond and compaction. No compacting shall be done when the material is too wet, from either rain or application of water, to compact it properly. At such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compaction, or such other precautions shall be taken as may be necessary to obtain proper compaction.

C. Special attention shall be given to compaction in places close to walls where motorized vehicular compaction equipment cannot reach. Within 3 feet of the back face of walls and within a greater distance at angle points of walls, each layer of backfill shall be compacted by mechanical rammers, vibrators or pneumatic tampers.

D. Each layer of fill or backfill shall be compacted at optimum moisture content. No subsequent layer shall be placed until the specified compaction is obtained for the previous layer.

E. Compaction Density: Compaction density shall be expressed as a percentage of maximum dry density at optimum moisture content according to ASTM D 1557 Method C. Density indicated is minimum required.

1. Under structures, building slabs, and steps: 95 %

2. Utilities, below pipe centerline: 95%

3. Utilities below unpaved surface, above pipe centerline: 92%

4. Utilities below paved surface, above pipe centerline: 95%

5. Embankments: 92%

6. Landscaped areas: 90 %.

7. Athletic fields and similar recreational fields: 93%

END OF SECTION

SECTION 31 2543

GEOTEXTILES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Furnishing and installation geotextile materials for the separation of earth materials.

2. Furnishing and installation geotextile materials for the stabilization of earth materials.

B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

A. State of Connecticut Department of Transportation (ConnDOT)

1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 817, 2016 and any supplements.

B. ASTM International (ASTM).

1. ASTM D4355 – Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.

2. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

3. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

4. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

5. ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile.

6. ASTM D4873 – Guide for Identification, Storage, and Handling of Geotextiles.

7. ASTM D6241 – Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.

8. ASTM D6706 – Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil.

C. Code of Federal Regulations (CFR)

1. 29 CFR Part 1926 Subpart P – OSHA Excavation Regulations 1926.560 through 1926.562 including Appendices A through F.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.

1.4 SUBMITTALS

A. Submit to Engineer for approval material specifications, manufacturer's product data, manufacturer's installation guidelines, and shop drawings for all materials furnished under this Section.

B. Connection details for geotextile.

C. Proposed mechanical connection devices.

1.5 DELIVERY, STORAGE AND HANDLING

A. Geotextile labeling, shipment, and storage shall follow ASTM D4873. Product labels shall be clearly labeled and/or marked to specifically identify each product and clearly show the manufacturer's name, style name, and roll number.

B. Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants. Protect rolls from crushing or abrasion during shipping and hauling.

C. Geotextile shall be stored on a prepared surface (not wooden pallets) and should not be stacked more than two rolls high. Storage shall be such that the geotextile is protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or cold, or other damaging circumstances. Temporary storage at the Project Site shall be away from standing water such that crushing or flattening of roll goods does not occur.

PART 2 PRODUCTS

2.1 SEPARATION GEOTEXTILE

A. Separation Geotextile shall be utilized to separate layers of earth materials in utility trenches, drains, layered systems and similar installations in a non-structural configuration.

1. Composition: Woven geotextile made of 100% polypropylene slit film yarns.

2. Physical properties:

Mechanical and Physical Properties of Separation Geotextile

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Grab Tensile Strength, Ultimate	ASTM D4632	Pounds	120
Grab Tensile Strength, Elongation at Ultimate	ASTM D4632	Percent (%)	50
Trapezoid Tear Strength	ASTM D4533	Pounds	50
CBR Puncture Strength	ASTM D6241	Pounds	310

Apparent Opening Size (AOS)	ASTM D4751	(U.S. Sieve)	70
Permittivity	ASTM D4491	sec^{-1}	1.7
Flow Rate	ASTM D4491	$gal/min/ft^2$	135
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70

2.2 LIGHT-DUTY STABILIZATION GEOTEXTILE

A. Light-Duty Stabilization Geotextile shall be utilized under temporary sidewalks and unit pavers when called-for.

1. Composition: Woven geotextile made of 100% polypropylene slit film yarns.

2. Physical properties:

Mechanical and Physical Properties of Light-Duty Stabilization Geotextile

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Tensile Strength @2% Strain (MD/CD)	ASTM D4595	Pounds/foot	600/600
Tensile Strength @5% Strain (MD/CD)	ASTM D4595	Pounds/foot	1620/1620
Flow Rate	ASTM D4491	$Gal/min/ ft^2$	70
Permittivity	ASTM D4491	sec^{-1}	90
Apparent Opening Size (AOS)	ASTM D4751	(U.S. Sieve)	40
Interaction Coefficient	ASTM D6706	-	0.89
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	90

MD – Machine Direction
CD – Transverse (Crosswise) Direction

2.3 STABILIZATION GEOTEXTILE

A. Stabilization Geotextile shall be utilized for stabilization of subgrades where unsuitable subsurface soil conditions are present. Stabilization geotextile shall only be utilized with the approval of Engineer.

1. Composition: Woven geotextile made of 100% polypropylene slit film yarns.

2. Physical properties:

Mechanical and Physical Properties of Stabilization Geotextile

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Grab Tensile Strength, Ultimate (MD/CD)	ASTM D4595	Pounds/foot	7200/5760
Tensile Strength at 2% Strain	ASTM D4595	Pounds/foot	1370/1560

Tensile Strength at 5% Strain	ASTM D4595	Pounds/foot	3600/3600
Tensile Strength at 10% Strain	ASTM D4595	Pounds/foot	6600/5760
Flow Rate	ASTM D4491	Gal/min/ ft^2	15
Permittivity	ASTM D4491	sec^{-1}	0.23
Apparent Opening Size (AOS)	ASTM D4751	(U.S. Sieve)	20
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	80

MD – Machine Direction
CD – Transverse (Crosswise) Direction

PART 3 EXECUTION

3.1 GENERAL

A. Install geotextile as shown on the Drawings or as called-for in the Specifications. Follow manufacture's guidelines.

B. Ensure that geotextile is protected during installation from clogging, tears, and other damage.

3.2 PIPE OR DRAINAGE SYSTEMS

A. Provide smooth side and bottom trench surfaces so the fabric does not bridge depressions in the soil and is not damaged by rock projections.

B. Use fabric of a width to permit a minimum trench-width overlap across the backfill at the trench top.

C. Lay the fabric flat in the prepared trench without stretching. Lay the top of the fabric back on the sides to allow for the placement of the aggregate backfill and pipe.

D. Overlap ends of rolls an amount equal to the trench width prior to fabric placement. Where pockets or cavities occur in the trench bottom or sides, fill them with acceptable granular material to prevent distortion or damage to the fabric.

E. Backfill aggregate and install pipe in a manner to prevent damage to the fabric. Compact aggregate backfill and overlap the fabric across the trench top. Do not allow the fabric to be exposed for more than 2 weeks without covering with backfill.

3.3 LAYER SEPARATION AND/OR STABILIZATION

A. Place fabric on a normally prepared subgrade area attending the full width of the sub-base layer being protected.

B. Place fabric in a loose and unstretched condition to minimize shifting, puncture, and/or tearing. Overlap fabric roll-ends and edges a minimum of 12 inches with adjacent material.

C. Place subbase material within 2 weeks after placement of fabric to minimize exposure. Place sub-base material in a manner to minimize slippage of the fabric. If excessive slippage occurs, use steel securing pins per manufacturer's guidelines.

END OF SECTION

DIVISION 32
EXTERIOR IMPROVEMENTS

SECTION 32 1216

BITUMINOUS CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

A. The work under this section consists of the production and placement of a smooth and dense bituminous concrete mixture with a uniform texture for a completed base course, the surface of an existing pavement or the surface of an existing pavement which has been brought to proper grade and cross section.

B. Section includes:

1. Asphaltic (Bituminous) concrete paving for street, driveway and parking areas.

2. Installation of bituminous concrete overlays over existing pavement, including surface preparation, truing and leveling pavement, tack coating and all other associated items and operations necessary and required to complete the installation.

3. Bituminous concrete surfaced sidewalk constructed on a gravel or reclaimed miscellaneous aggregate base course in the locations and to the dimensions and details shown on the plans or as directed by Engineer and in accordance with these specifications.

4. Bituminous concrete paving for running track base construction.

5. Bituminous concrete lip curbing.

6. Adjustment of existing castings to finished grade.

7. Saw cutting existing edge of pavements for the construction of a proper pavement butt.

1.2 REFERENCES

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. State of Connecticut Department of Transportation (ConnDOT).

1. Standard Specifications for Roads, Bridges and Incidental Construction, Form 817, 2004 and any supplements.

D. American Association of State High and Transportation Officials (AASHTO).

1. AASHTO M-17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.

2. AASHTO M 82, Cutback Asphalt (Medium-Curing Type) .

3. AASHTO M-208 - Standard Method of Test for Unconfined Compressive Strength of Cohesive Soil-ASTM Designation D 2166.

4. AASHTO M-320 - Standard Specification for Performance-Graded Asphalt Binder.

5. AASHTO R-26 - Standard Recommended Practice for Certifying Suppliers of Performance-Graded Asphalt Binders.

6. AASHTO R-29 - Standard Practice for Grading or Verifying the Performance Grade of an Asphalt Binder.

7. AASHTO T-27 - Sieve Analysis of Fine and Course Aggregates.

8. AASHTO T-84 - Specific Gravity and Absorption of Fine Aggregates.

9. AASHTO T-85 - Specific Gravity and Absorption of Coarse Aggregates.

10. AASHTO T-96 - Standard Method of Test for Resistance to Degradation of small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

11. AASHTO T-104 Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.

12. AASHTO T-209 - Maximum Specific Gravity and Density of Bituminous Paving Mixtures.

13. AASHTO T-245 - Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

E. The Asphaltic Institute (AI)

1. MS-2: Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.

2. M-19: Basic Asphalt Emulsion Manual.

F. Hot Mix Asphalt Paving Handbook 2000 - U.S. Army Corps of Engineers, UN-13 (CE MP-ET)

G. American Society for Testing and Materials (ASTM)

1. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.

2. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.

H. American Sports Builders Association (ASBA)

1. Running Tracks: A Construction and Maintenance Manual – Ninth Edition

1.3 JOB CONDITIONS

A. Weather Limitations

1. The bituminous concrete mixture shall not be placed whenever the surface is wet or frozen or when the temperature is outside the limitations stated in Table 1 below unless the contractor has a Cold Weather Paving procedure approved by Engineer. Contractor shall be responsible for submitting the procedure at least one week in advance of any

paving operations that may result in placement of the bituminous concrete pavement outside of the temperature limitations stated in the following:

Table 1
Temperature Limitations for Placement of Bituminous Concrete Pavement (ConnDOT 4.06.03 (4))

Lift thickness (Inches)	Minimum Air and Surface Temperature (Degrees F)	
	Final Course	All Other Courses
Less than 1- 1/2 inch	50	50
1-1/2 to 2-1/2 in	40	40
Over 2-1/2 in.	40	32

2. Apply tack coat where indicated on the drawings and when ambient temperature is above 40°F, and when temperature has been above 35°F for 12 hours immediately prior to application. Do not apply when base is wet, contains excess moisture, or during rain.

1.4 SUBMITTALS

A. Request for approval of all material sources of supply.

B. Material Safety Data Sheet (MSDS) for each grade of binder.

C. Design Mix: Before any bituminous concrete paving is constructed, submit actual design mix to Engineer for review and/or approval. Design mix submittal shall follow the format as indicated in the Asphalt Institute Manual MS-2, Marshall Stability Method; and shall include the type/name of the mix, gradation analysis, grade of asphalt cement used, Marshall Stability (lbs.), flow, and effective asphalt content (percent).

D. Material Certificates: Submit Material Certificate to Engineer, which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.

1.5 COORDINATION

A. Contractor shall coordinate with all other trades, especially underground Utility Contractors, in order to prevent covering up unfinished or uninspected work and loss of time or labor by improper scheduling. Any rework shall be done at no cost to the Owner.

1.6 SUBGRADE TESTING

A. Subgrade bearing capacity shall be determined by testing. The minimum CBR (California Bearing Ratio) shall be 10. The Contractor shall perform CBR tests as necessary, but in no case less than one test for each 1,000 square yards of paved area.

B. Contractor shall remove any subgrade areas not meeting the minimum CBR during subgrade preparation. Areas of subgrade removal shall be filled and compacted with suitable material at no extra cost to Owner.

1.7 EQUIPMENT

A. Contractor shall have the paving and compaction equipment at the Project site in a sufficient amount of time before operations so that it can be inspected and approved by Engineer. The Contractor shall repair or replace any equipment found worn or defective, either before or during paving, to the satisfaction of Engineer.

B. Pavers: Each paver shall have a receiving hopper with sufficient capacity to provide for a uniform spreading operation and a distribution system that places the mix uniformly, without segregation. The paver shall be equipped with a vibratory screed system with heaters or burners. The screed system shall be capable of producing a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Pavers with extendible screed units as part of the system shall have auger extensions and tunnel extenders as necessary. The screed unit shall have automatic screed controls for grade and slope unless otherwise approved by the Engineer. The controls shall automatically adjust the screed to compensate for irregularities in the preceding course or existing base. The controls shall maintain the proper transverse slope and be readily adjustable, and shall operate from a fixed or moving reference such as a grade wire or floating beam.

C. Rollers: All rollers shall be self-propelled and designed for compaction of bituminous concrete.

1. Non-vibratory (static) rollers shall be steel wheel types. These rollers may also be of the type that can be used as vibratory rollers.

2. Pneumatic tire rollers shall be self-propelled and equipped with wide-tread compaction tires capable of exerting an average contact pressure from 60 to 90 pounds per square inch uniformly over the surface, adjusting ballast and tire inflation pressure as required. The Contractor shall furnish evidence regarding tire size; pressure and loading to confirm that the proper contact pressure is being developed and that the loading and contact pressure are uniform for all wheels.

3. Vibratory rollers shall be equipped with indicators that provide the operator with amplitude, frequency and speed settings/readouts to measure the impacts per foot during the compaction process.

PART 2 PRODUCTS

2.1 GENERAL

A. All sources of materials used for the production of bituminous concrete materials must be approved by Engineer prior to their use. Such materials shall include coarse aggregate, fine aggregate, mineral filler and designated bitumen combined to meet the composition limits by weight (mass) and other requirements stated in Table 2.

B. An adequate quantity of each size aggregate, mineral filler and bitumen shall be maintained at the bituminous concrete plant site at all times while the plant is in operation to ensure that the plant can consistently produce bituminous concrete materials that meet the job mix formula (JMF) as specified in Article 2.5. The quantity of such material shall be approved by Engineer on an individual plant basis and is dependent upon the plant's daily production capacity, but shall never be less than one day’s production capacity.

2.2 MINERAL AGGREGATE

A. Coarse Aggregate

1. Coarse aggregate shall consist of clean, hard, tough, durable fragments of crushed stone or crushed gravel of uniform quality. Aggregates from multiple sources of supply shall not be mixed or stored in the same stockpile.

2. Basis of Acceptance: The request for approval of the source of supply shall include a washed sieve analysis in accordance with AASHTO T-27. The apparent specific gravity (Gsa), bulk specific gravity (Gsb) and percent absorption (Paw) shall be determined in accordance with AASHTO T-85. The aggregate shall not contain more than 1% crusher dust, sand, soft disintegrated pieces, mud, dirt, organic and other injurious materials. When tested for abrasion using AASHTO T-96, the aggregate loss shall not exceed 40.0%. When tested for soundness using AASHTO T-104 with a magnesium sulfate solution, the coarse aggregate shall not have a loss exceeding 10.0% at the end of 5 cycles.

B. Fine Aggregate

1. Fine aggregate shall consist of clean, hard, tough, rough-surfaced and angular grains, of natural sand; manufactured sand prepared from washed stone screenings; stone screenings, slag or gravel; or combinations thereof. Fine aggregates from multiple sources of supply shall not be mixed or stored in the same stockpile.

2. Basis of Acceptance: The request for approval of the source of supply must include the location, manufacturing and processing methods. The request for approval shall also include a washed sieve analysis in accordance with AASHTO T-27. Any fine aggregate component or final combined product shall have 100% passing the 3/8 inch (9.5 millimeter) sieve. The apparent specific gravity (Gsa), bulk specific gravity (Gsb) and percent absorption (Paw) shall be determined in accordance with AASHTO T-84. The fine aggregates shall be free from injurious amounts of clay, loam, and other deleterious substances.

C. The use of reclaimed asphalt pavement in new bituminous pavement is not permitted.

2.3 MINERAL FILLER

A. Mineral filler shall consist of finely divided mineral matter such as rock dust, including limestone dust, slag dust, hydrated lime, hydraulic cement, or other approved mineral matter. At the time of use it shall be freely flowing and devoid of agglomerations.

B. Basis of Acceptance: The request for approval of the source of supply shall include the location, manufacturing process, handling and storage methods for the material. Mineral filler shall conform to the requirements of AASHTO M-17.

2.4 LIQUID BITUMINOUS MATERIALS:

A. Performance grade (PG) binder.

1. Material shall have uniformly mixed and blended liquid bituminous materials that are free of contaminants such as fuel oils and other solvents. Such materials shall be properly heated and stored to prevent damage or separation. PG binders used in the production of bituminous materials shall be approved by Engineer. PG binders that are modified with fillers, extenders, reinforcing agents, adhesion promoters, additives, and thermoplastic polymers shall be approved for use only with the prior written approval from Engineer.

2. Basis of Acceptance: The request for approval of the source of supply shall list the location where the materials will be produced, and manufacturing, processing, handling and storage methods along with necessary certification in accordance with AASHTO R-26. The PG binder utilized for the production of bituminous materials shall consist of the grade specified in the Contract when tested in accordance with AASHTO M-320 and AASHTO R-29.

B. Cut-backs (medium cure type).

1. The liquid petroleum materials for this item shall be produced by fluxing an asphalt base with appropriate petroleum distillates to produce the grade specified.

2. Basis of Acceptance: The request for approval of the source of supply shall be submitted at least seven days prior to its use listing the location where the materials will be produced, and manufacturing, processing, handling and storage methods. The liquid asphalt shall be MC-250 conforming to AASHTO M-82.

C. Emulsions

1. Emulsified asphalt shall be homogeneous and not be used if exposed to freezing temperatures.

2. Basis of Acceptance: The request for approval of the source of supply must include the location where the materials will be produced, and manufacturing, processing, handling and storage methods.

a. Emulsified asphalts shall conform to the requirements of AASHTO M-140. Materials used for tack coat shall be grade RS-1. When ambient temperatures are 80˚F (27˚C) and rising, grade SS-1 or SS-lh may be substituted if approved by Engineer.

b. Cationic emulsified asphalt shall conform to the requirements of AASHTO M-208. Materials used for tack coat shall be grade CRS-1. The settlement and demulsibility test will not be performed unless deemed necessary by the DRM. When ambient temperatures are 80˚F (27˚C) and rising, grade CSS-1 or CSS-lh may be substituted if approved by Engineer.

2.5 MIX DESIGN AND JOB MIX FORMULA (JMF)

A. Marshall Method – HMA S0.5, S0.375, S0.25, S1, Curb Mix

1. Requirements: The Marshall method shall be employed to develop a bituminous concrete mix design that includes a JMF consisting of target values for gradation and bitumen content for each class of bituminous concrete designated for the project in accordance with the latest Asphalt Institute's MS-2 manual. Each class of bituminous concrete must meet the requirements as shown in the Table 2.

2. Basis of Acceptance: The Contractor shall submit to the Engineer a request for approval of the JMF in accordance with one of the methods described in c, d, and e below. Prior to the start of any paving operations the JMF and production percentage of bitumen must be approved by the Engineer, and the Contractor must demonstrate the ability to meet the approved JMF and production percentage of bitumen for each class of material. Additionally, the fraction of material retained between any two consecutive sieves shall not be less than 4%.

3. Contractor shall test each class of material for compliance with the submitted JMF and Table 2. The maximum theoretical density (Gmm) will be determined by AASHTO T-209 (modified). If the material does not meet the requirements, the JMF shall be adjusted within the ranges shown in Table 2 until an acceptable material is produced. All equipment, tests and computations shall conform to the Marshall method in accordance with AASHTO T-245 (modified).

Table 2
Ranges for Bituminous Concrete Hot Mix Asphalt Mixtures

Class	HMA S0.25	HMA S0.375	HMA S0.5	Curb Mix
Grade of PG	PG 64-22	PG 64-22	PG 64-22	PG 64S-22
Binder Content (%)	7.5-10.0	5.0-6.5	5.0-8.0	6.5-9.0
Sieve Size				
2”	--	--	--	--
1.5”	--	--	--	--
1”	--	--	--	--
¾”	--	--	100	--
½”	100	100	90-100	100
3/8”	97-100	90-100	90 Max.	95-100
No. 4	90 Max.	90 Max.	--	65-87
No. 8	32-67	32-67	28-58	40-70
No. 16	--	--	--	--
No. 200	2-10	2-10	2-10	3-8
Mixture Temperature				
Aggregate (°F)	280-350 °F	280-350 °F	280-350 °F	280-350 °F
Mixture (°F)	265-325 °F	265-325 °F	265-325 °F	265-325 °F
Voids (%)		3.0-6.0	2.0-5.0	0-4.0
Stability (lbs min.)		1200	1000	1000
Flow (inches)		0.08-0.15	0.08-0.15	0.08-0.18
VMA (%)		15:16	-	-

4. An approved JMF from the previous operating season may be acceptable to the Engineer provided that there are no changes in the sources of supply for the coarse aggregate, fine aggregate, recycled material (if applicable) and the plant operation had been consistently producing acceptable material.

5. Contractor shall not change sources of supply after a JMF has been approved. Before a new source of supply for materials is used, a new JMF shall be submitted to the Engineer for approval.

B. Marshall mixture (virgin)

1. For Bituminous concrete materials that contain no recycled material, the limits prescribed in Table M.04.01 govern. Contractor shall submit to the Engineer for approval, a JMF with the individual fractions of the aggregate expressed as percentages of the total weight (mass) of the mix and the source(s) of all materials. The JMF shall indicate two bitumen contents; the JMF target percentage and a production percentage (actual amount added to mix) of bitumen for each mix class by total weight (mass). For

surface course HMA S0.375, a 0.45 power gradation chart shall also be submitted on which is plotted the percentage passing each sieve. The JMF shall also indicate the target temperature of completed mixture as it is dumped from the mixer.

2.6 BITUMINOUS CONCRETE BINDER COURSE

A. ConnDOT HMA S0.5.

2.7 BITUMINOUS CONCRETE TOP/FINISH COURSE

A. ConnDOT HMA S0.375.

2.8 BITUMINOUS CONCRETE CURBING

A. ConnDOT Curb Mix.

2.9 BITUMINOUS CONCRETE SIDEWALKS

A. ConnDOT HMA S0.375.

2.10 RUNNING TRACK BASE

A. Binder Course: ConnDOT HMA S0.5.

B. Finish Course: ConnDOT HMA S0.375.

2.11 EQUIPMENT

A. Maintain equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.

PART 3 EXECUTION

3.1 GENERAL

A. Contractor shall install all pavements as specified in the location and to the grades as shown on the Drawings and/or approved by Engineer. Materials, methods of construction, and type and thickness of pavement courses shall be as shown on the Details of the Drawings and as specified herein.

B. Owner and its representatives shall have access to all parts of the Work under construction at all times.

3.2 PREPARATION FOR PAVEMENT INSTALLATION

A. Remove loose material from compacted base material surface immediately before proofrolling.

B. Proof roll prepared base material surface to check for areas requiring additional compaction and areas requiring removal and recompaction.

C. Do not begin paving work until deficient base material areas have been corrected and are ready to receive paving.

D. Check all frames, covers, grates, water valve boxes and other miscellaneous castings that are located in the proposed pavement areas to insure that all such items have been correctly positioned and set to the proper slope and elevation. All covers and grates are to be set flush with the required finished surface. No depressions or mounds will be permitted in the

pavement to accommodate inaccuracies in the setting of these appurtenances. All correctional work that may be necessary, as determined by Engineer, shall be performed at the Contractor's expense.

E. All vertical surfaces of structures and existing concrete surfaces in contact with new bituminous pavement shall be painted with a uniform coating of an approved bituminous emulsion material. Extreme care shall be exercised in the application of this material to prevent splattering or staining of surfaces that are to be exposed after the Work is completed. Surfaces that are stained as a result of the Contractor's operation shall be repaired and/or replaced to the satisfaction of Engineer at Contractor's expense.

F. Bituminous paving shall not be applied until the Engineer inspects and approves the finished base.

G. All existing paved surfaces to be overlayed must be thoroughly cleaned by a self-propelled sweeper. Areas inaccessible by power sweeper shall be broom swept until all non-pavement surface matter is removed.

3.3 TRANSPORT

A. Mixture shall be transported from the mixing plant in trucks that have previously been cleaned of all foreign material and that have no gaps through which material might inadvertently escape. The use of kerosene, gasoline, fuel oil, or similar products for the coating of the inside of truck bodies is prohibited. Truck body coating and cleansing agents must not have a deleterious effect on the transported materials. If such agents are applied, truck bodies shall be raised immediately prior to loading to remove any excess agent.

B. Loaded trucks shall be tightly covered with waterproof covers acceptable to the Engineer. Mesh covers are prohibited. The front and rear of the cover must be fastened to minimize air infiltration.

C. Do not exceed legal weight limits.

3.4 APPLICATION

A. Tack Coat

1. Apply to contact surfaces of all portland cement concrete surfaces and surfaces abutting or projecting into bituminous concrete pavement.

2. Apply tack coat to existing bituminous concrete surfaces at match points and where indicated on the drawings.

3. Apply at a minimum rate of 0.05 gallons per square yard of surface.

4. Allow to dry until at proper condition to receive paving.

3.5 PLACING AND COMPACTING

A. Prior to the placement of the bituminous concrete, the underlying base course shall be brought to the plan grade and cross section within the allowable tolerance. Immediately before placing the mixture, the area to be surfaced shall be cleaned by brooming or by other means acceptable to the Engineer. Place bituminous concrete mixture on completed, compacted base surface, spread, and strike off.

B. Whenever possible, all pavement shall be spread by a self-propelled finishing machine. At inaccessible or irregular areas, pavement may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated course aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster than they can be properly spread. Workers shall not stand on the loose mixture while spreading.

C. Paving Machine Placement: Apply successive lifts of bituminous concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10'-0" wide.

D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construction joints shall have the same texture, density, and smoothness as other sections of bituminous concrete courses. Clean contact surfaces and apply tack coat.

E. The mixtures shall be placed and compacted to provide a smooth and dense surface with a uniform texture. When overtaken by sudden storms, the Engineer may permit placement of the bituminous concrete to continue up to the quantity of material that is in transit from the plant.

F. The mixture shall be placed at a temperature that is within 25ºF of the approved job mix formula.

G. Before rolling is started, the mat shall be checked for defects in material or placement. Such defects shall be corrected to the satisfaction of the Engineer. Where it is impracticable due to physical limitations to operate the paving equipment, the Engineer may permit the use of other methods or equipment. Where hand spreading is permitted, the mixture shall be placed by means of suitable shovels and other tools, and in a uniformly loose layer at a depth that will result in a completed pavement having the designed depth. Any deviation from standard crown or section shall be immediately remedied by placing additional material or removing surplus as directed by the Engineer. The Engineer may direct that other means of spreading be used to ensure a better control of the depths of material and the finished surface.

H. A thin uniform coating of tack coat shall be applied to the pavement immediately before overlaying and be allowed sufficient time to break (set). All surfaces that have been in place longer than five calendar days shall have an application of tack coat. A tack coat shall be applied to all contact surfaces such as gutters, manholes and concrete barriers. The tack coat shall be applied by a non-gravity pressurized spray system that results in uniform overlapping coverage at an application rate of 0.05 to 0.15 gallons per square yard. Gravity-fed systems are not acceptable for tack coat application. The Engineer must approve the equipment and the method of measurement prior to use. The material for tack coat shall not be heated in excess of 160°F and shall not be further diluted.

I. Refueling of equipment is prohibited in any location on the paving project where fuel might come in contact with bituminous concrete mixtures already placed or to be placed. Solvents for use in cleaning mechanical equipment or hand tools shall be stored clear of areas paved or to be paved. Before any such equipment and tools are cleaned, they shall be moved off the paved or to-be-paved area; and they shall not be returned for use until after they have been allowed to dry.

J. Immediately before placing bituminous concrete on a waterproofing membrane, the membrane shall be swept clean. If the membrane is damaged it shall be repaired by patching as directed by the Engineer.

K. Temporary and permanent transverse joints shall be formed by saw-cutting a sufficient distance back from the previous run, existing bituminous concrete pavement, or bituminous concrete driveways to expose the full depth of the course. On any cold joint, immediately prior to additional bituminous concrete materials being placed, a brush of tack coat shall be used on all contact surfaces.

L. The longitudinal joint shall be offset at least six inches from the joint in the course immediately below. The joint in the final surface shall be at the centerline or at lane lines.

3.6 ROLLING AND COMPACTION

A. In general, rolling shall consist of initial or breakdown rolling, intermediate rolling and final or finish rolling. The contractor shall furnish a sufficient number and type(s) of rollers for each paving machine to properly compact the mat. When operating the roller in the vibratory (dynamic) mode, the operator shall maintain a minimum of ten to twelve impacts per foot. All vibratory rollers shall be shut off from the vibrating mode when reversing directions and be equipped with automatic reversing eccentrics (weights). The use of a vibratory roller in the dynamic or vibratory mode is prohibited on concrete structures such as bridges and catch basins.

B. If the Engineer determines that the use of vibratory compaction equipment may damage highway components, utilities or adjacent property, the Contractor shall provide alternate compaction equipment to meet specification requirements unless otherwise approved by the Engineer. The completed pavement course on roadways and bridges will have the mat and longitudinal joints tested for compaction in accordance with the "Density Testing Procedure" established by the Department's Director of Research and Materials. Each course placed at a depth of one and one-half inches or greater shall have the mat and longitudinal joints compacted to a minimum of 92.0 percent and no more than 97.0 percent density as determined by AASHTO T209 (modified). Class 4 bituminous concrete is excluded from the joint density requirements.

C. Surface Tolerance: The Contractor shall perform random spot-checks with a contractor-supplied ten-foot straightedge placed parallel to the centerline of the road to verify surface tolerances. The final surface course will not vary more than 1/4 inch from a ten-foot straightedge and 3/8 inch for all other courses. Such tolerance will apply to all paved areas including bridge approaches, headers, and existing pavement. Any irregularity of the surface exceeding these limits shall be corrected.

D. Protection of the Work: All sections of the newly finished pavement shall be protected by the Contractor from damage by the Contractor’s equipment and traffic.

E. Corrective Work Procedures: Any portion of the completed pavement determined by the Engineer to be defective in surface texture, density or composition, or that does not comply with the requirements of the specifications shall be corrected at the expense of the Contractor. Any corrective courses placed as the final wearing surface shall not be less than one and one-half inches in depth after compaction.

3.7 DEFICIENT PAVEMENT

A. If pavement placed by the Contractor does not meet the specifications, and the Engineer requires its replacement or correction, the Contractor shall:

1. Propose a corrective procedure to the Engineer for review and approval prior to any corrective work commencing. The proposal shall include:

a. Limits of pavement to be replaced or corrected, indicating stationing or other landmarks that are readily distinguishable.

b. Schedule.

c. Construction method and sequence of operations.

d. Methods of maintenance and protection of traffic.

e. Material sources.

f. Names and telephone numbers of supervising personnel.

2. Perform all corrective work in accordance with the Contract and the approved corrective procedure.

B. Cut Bituminous Concrete Pavement

1. Make a straight-line cut in the bituminous concrete pavement to the lines delineated on the Drawings or as directed by the Engineer. The cut shall provide a straight, clean, vertical face with no cracking, tearing or breakage along the cut edge.

3.8 BITUMINOUS CONCRETE SIDEWALKS

A. Forms: Where walls, curbing or other suitable permanent supports are not present, satisfactory forms shall be installed to assist in securing alignment and adequate compaction of the base and surface courses. All forms shall be removed and backfilled with proper material.

B. Placing Bituminous Concrete: The bituminous concrete walk surface shall be laid in a single course to a depth after compaction of 4 inches, unless otherwise detailed or directed.

C. Unless otherwise directed, the walk shall have a minimum pitch of 3/16 of an inch per foot of width to provide for proper drainage.

1. Spreading Mixture. The mixture shall be dumped, as needed, in wheelbarrows or an approved steel dump sheet outside the areas on which it is to be placed. It shall then be immediately distributed into place by means of shovels and raked into a uniformly loose layer to the full width required and of such depth that, when the Work is completed, it shall conform to the grade and surface contour required.

2. Rolling. The surface shall be rolled with a self-propelled, tandem roller weighing not less than 1-1/2 tons and not more than 5 tons. In places inaccessible to a power roller, compaction shall be obtained by means of mechanical rammers or by hand tampers weighing not less than 50 pounds and having a tamping face not exceeding 100 square inches.

3. Testing Surface. When tested with a 10-foot straightedge placed parallel to the centerline of the courses, there shall be no deviation from a true surface in excess of ¼ of an inch.

3.9 BITUMINOUS CONCRETE RUNNING TRACK BASE

A. Install HMA in accordance with weather condition and with a temperature of 50 °F and rising.

B. Keep surface course longitudinal joints smooth and true. No deviation from level and true as required of the mat will allow. Detail and sumit to the owner a paving plan on the site plan prior to placement of asphalt. The entire athletic surface course shall be paved on the same day.

C. Start rolling as soon as the HMA can be compacted without displacement. Rolling shall continue until HMA is thoroughly compacted and all roller marks have disappeared. Compact HMA to a minimum in-place density of 94% of the Gmm.

D. Ensure smoothness in no greater than ¼" in 10 feet for base course and 1/8" in 10 feet for surface course.

E. Keep thickness of the overall mat within ¼" of the specified plan thickness at all locations.

F. Minimize construction, longitudinal, and transverse joints left open for an extended period of time.

G. Compact all joints to provide for a neat, uniform and tightly bonded joint that will meet both surface tolerances and density requirements.

H. Off set joints a minimum of 6 inches between lifts of asphalt.

3.10 FIELD QUALITY CONTROL

A. Independent Testing Laboratory: Contractor shall retain a third-party testing entity to perform construction testing of in-place bituminous concrete courses for compliance with requirements for thickness and surface smoothness. Contractor shall pay all costs for testing.

B. Bituminous surface and base courses shall be randomly cored at a minimum rate of one core for every 20,000 square feet of paving. However, no less than three cores in light duty areas and three cores in heavy duty areas shall be obtained. Coring holes shall be immediately filled with full-depth asphalt or with concrete. Bituminous concrete pavement samples shall be tested for conformance with the mix design.

C. Grade Control: Establish and maintain required lines and elevations.

D. Thickness: In-place compacted thickness shall not be less than the thickness specified on the drawings. Areas of deficient paving thickness shall receive a tack coat and a minimum 1" thickness, at the discretion of Engineer, until specified thickness of the course is met or exceeded at no additional expense to Owner.

E. Surface Smoothness: Testing shall be performed on the finished surface of each bituminous concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. The results of these tests shall be made available to Engineer upon request. Surfaces will not be acceptable if exceeding following tolerances for smoothness:

1. Bituminous Concrete HMA S1: tolerance +/- 3/4 inch

2. Bituminous Concrete HMA S0.5, S0.375, S0.25: tolerance +/- 1/2 inch

F. Check surfaces areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Engineer.

G. Compaction: Field density tests for in-place materials shall be performed by examination of field cores and shall have a minimum compacted density of 95% of laboratory Marshall Density in accordance with one of the following standards:

1. Bulk Specific Gravity and Density of Compacted Bituminous Mixture Using Paraffin-Coated Specimens: ASTM D1188.

2. Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface Dry Specimens: ASTM D2726.

3. Rate of testing shall be one core per 20,000 square feet of pavement, with a minimum of 3 cores from heavy-duty areas and 3 cores from standard-duty areas. Cores shall be cut from areas representative of the project.

4. Areas of insufficient compaction shall be delineated, removed, and replaced in compliance with the specifications at no expense to the Owner.

3.11 MEETING EXISTING PAVEMENTS

A. Where new pavements are to meeting existing pavements, the Contractor shall saw cut the existing pavements so that there will be a vertical butting surface between the old and new pavements. Sawcutting of existing pavements shall be along neat, straight and even lines, and shall be done in such a manner so as not to damage the adjacent pavement which is to remain.

B. Full-Depth Pavement - The existing pavement shall be sawcut by an approved method for the full depth of the pavement prior to placement of any new pavement. The existing bituminous surface shall be trimmed to a neat true line with straight vertical edges free from irregularities, and the trimmed edges shall be treated with a light coating of asphaltic emulsion immediately prior to the installation of the new abutting bituminous concrete surface course to provide a bond between the old and new pavement. The new compacted pavement surface shall be finished flush with the adjacent pavement.

C. Bituminous Concrete Overlays: A line shall be cut by an approved method where the new pavement is to meet the existing pavement. The existing bituminous surface shall be trimmed to a neat true line with straight vertical edges free of irregularities for a minimum depth of one and one half inches. Sufficient pavement shall then be ground by machine method leaving a tapered Section of pavement ground one and one-half inches thick at the pavement butt and feathered back to meet the existing pavement surfaces. The ground, tapered transition section width shall be two feet at driveways and six feet in roadways and parking areas. Immediately prior to the placement of the bituminous concrete overlay the trimmed edges of the existing pavement shall be treated with a coating of asphaltic emulsion to bond the new pavement to the old pavement. The new pavement surface shall be finished flush with the adjacent pavement. Surface seam of pavement joint shall be painted with emulsion and covered with sand or proper material to absorb excess emulsion.

END OF SECTION

SECTION 32 1623

CURBING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Cast-in-place concrete curb.

2. Bituminous concrete lip curb.

B. Work shall also include all associated items and operations necessary and required to complete the installations, including, but not limited to, surface preparation, finishing and cleanup.

C. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

D. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. United States Code of Federal Regulations (CFR)

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. State of Connecticut Department of Transportation (ConnDOT)

1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 817, 2016 and any supplements.

D. ASTM International (ASTM).

1. ASTM C33 – Standard Specification for Concrete Aggregates.

2. ASTM C94 – Standard Specification for Ready-Mixed Concrete.

3. ASTM C150 – Standard Specification for Portland Cement.

4. ASTM D235 – Standard Specification for Mineral Spirits (Petroleum Spirits).

5. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes

6. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

7. ASTM C309 – Standard Specification for Liquid Membrane - Forming Compounds for Curbing Concrete.

8. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.

9. ASTM C989 – Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.

10. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

11. ASTM D1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

12. American Concrete Institute (ACI)

13. ACI 304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

E. American Association of State High and Transportation Officials (AASHTO)

1. AASHTO M 6 – Standard Specification for Fine Aggregate for Portland Cement Concrete.

2. AASHTO M 85 – Standard Specification for Portland Cement (Chemical and Physical).

3. AASHTO M 133 – Standard Specification for Preservatives and Pressure Treatment Processes for Timber.

4. AASHTO M 213 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

5. AASHTO M 233 – Standard Specification for Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.

6. AASHTO M 240 – Standard Specification for Blended Hydraulic Cement.

7. AASHTO T11 – Standard Method of Test for Materials Finer Than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.

8. AASHTO T21 – Standard Method of Test for Organic Impurities in Fine Aggregate for Concrete.

1.3 SUBMITTALS

A. Submit Shop Drawings, manufacturer's literature, material certificates or other data indicating compliance with these Specifications.

B. Precast Curbing: Submit for approval, data indicating size, shape and dimensions, finish and setting method.

C. Stone Curbing: Submit for approval, the name of the quarry and the type of curb which the Contractor proposes to use. Samples of curbing shall be submitted for approval only when requested by the Engineer. Such submission shall be made sufficiently in advance of ordering so that the Engineer may have an opportunity to judge the granite, both as to quality and appearance.

D. Precast Curbing: Submit representative test specimens of the cured concrete used in precast units showing a compressive strength of 4,000 pounds prior to shipping any units.

E. Submit testing data for concrete as required by Section 03 3200 – Site Cast-in-Place Concrete.

1.4 DELIVERY, STORAGE AND HANDLING

A. Granite and precast concrete curb units shall be delivered to the job adequately protected from damage during transit.

B. Curbing shall be protected against staining, chipping, and other damage. Cracked, badly chipped, or stained units will be rejected and shall not be employed in the Work.

PART 2 PRODUCTS

2.1 CAST-IN-PLACE CONCRETE CURB

A. Concrete and reinforcement for cast-in-place concrete curbs shall be as specified in Section 03 3200 – Site-Cast-in-Place Concrete.

2.2 BITUMINOUS CONCRETE LIP CURBING

A. Bituminous concrete for curbing shall be as specified in Section 32 1216 – Bituminous Pavement.

PART 3 EXECUTION

3.1 GENERAL

A. Trenching, excavation, backfilling, and compaction shall be completed in accordance with Section 31 2310 – Earthwork, except as modified within this Section.

3.2 CAST-IN-PLACE CONCRETE CURB

A. General Requirements: Concrete curb shall be constructed of concrete and shall be cast-in-place on the prepared subbase in accordance with the dimensions and details line and grade shown on the Drawings. Curbing shall be constructed using conventional forms and in segments separated by construction joints and expansion joints as specified herein. This item shall consist of concrete curbing constructed or as ordered and in conformity with these specifications.

B. Forms: Forms shall be metal or acceptable planed and matched lumber, straight and free from warp or other irregularities that will adversely affect the installation. Forms shall conform to the curb cross-section shown on the Drawings and shall be carefully set to line and grade and thoroughly braced and secured in place so that there will be no displacement during placement of the concrete. All forms shall be thoroughly cleaned prior to reuse.

C. Placing of Concrete: Prior to placement of the concrete, the subgrade shall be moistened and the contact surfaces of the forms shall be given a light coating of oil that will not discolor the concrete. Concrete shall then be placed in the form as near to its final position as practicable, struck off with a template, spaded to prevent “rock-pockets” or “honey combing” adjacent to the forms and finished to a smooth even surface. The concrete may be compacted by mechanical vibrators if approved by Engineer. Placing by slip form methods shall be approved by Engineer.

D. Expansion Joints: Vertical expansion joints shall be located approximately every seventy-five (75) feet and shall be so arranged that they shall match expansion joints in any adjacent concrete pavements and sidewalks. Unless directed otherwise, expansion joints shall also be installed at the PC and PT of all radius curb. Expansion joints shall be constructed vertical, plumb, and at right angles to the face of the curb.

1. Prior to concreting, all exposed surfaces of the wood filler shall be given a light brush coating of form oil.

2. They shall be one-half (½) inch in width and formed with premolded bituminous joint filler cut to conform to the cross-section of the curb/curb gutter.

E. Construction Joints: Vertical construction joints shall be located approximately every fifteen (15) feet being equally spaced between expansion joints. The length of these curb/curb gutter segments may be varied slightly for closures but in no case shall they be less than eight (8) feet. Construction joints shall be vertical, plumb and at right angles to the face of the curb and shall be formed by approved method that will provide complete separation of the curb segments during the placing of the concrete. If curb is formed by slip form methods, the joints shall be sawed as soon as practicable after the concrete has set to preclude raveling during the sawing and before any shrinkage cracking occurs in the concrete.

F. Finishing: Forms shall be left in place for twenty-four (24) hours or until the concrete has sufficiently hardened as determined by Engineer so that they can be removed without injury to the curb. Upon removal of the forms, the exposed faces of the curb/curb gutter shall be immediately rubbed to a uniform surface. Rubbing shall be performed by experienced and competent concrete finishers. No plastering will be permitted.

3.3 BITUMINOUS CONCRETE LIP CURB

A. General Requirements

1. Bituminous curbing shall be constructed by the use of an approved self-propelled extruding curb machine equipped with a material hopper, distributing screw and curb forming device capable of placing the bituminous mixture to the required lines, grades and proper curb cross-section. Prior to the placement of any curb, Contractor shall submit a detail of the cross-section of the curb mold that he proposes to use to Engineer for approval.

B. Surface Preparation

1. When curbing is to be placed on existing bituminous pavements, concrete pavements or newly laid bituminous pavements which have been in place more than twenty-four (24) hours, the surface on which the curb is to be placed shall be swept and cleaned, thoroughly dried, and immediately prior to placement of the curb, the surface to be occupied by the curb shall be given an application of tack coat material.

2. Prevent spread of tack coat material beyond the area to be occupied by the curb.

3. Recently placed bituminous concrete pavement, which have been placed less than twenty-four (24) hours prior to placement of the curb need only be thoroughly swept and cleaned.

C. Placing and Compaction

1. The hot bituminous mixture shall be placed in the hopper of the curb paver without segregation and extruded through the mold form to provide the proper compaction and surface texture.

2. The curb paver shall be properly supported and weighted during operation along the edge of the pavement and shall be guided along string or chalk lines to maintain the proper alignment and level of the completed curb.

3. Any portions of the completed curb, which are not satisfactorily compacted, or show signs of sagging, cracking, or distortion, or do not conform to the required lines, grades or cross-section for any reason, and which cannot be satisfactorily repaired during construction, shall be removed and replaced at no additional cost to the Owner.

D. Joints

1. Bituminous curb construction shall be a continuous operation in one direction only, to eliminate joints. Excessive joints will be cause for rejection of entire length of installation.

2. When the placing of the curb is discontinued for a length of time that permits the mixture to become chilled, the curb shall be cut in a true vertical plane and the exposed end painted with a thin uniform coat of hot asphalt cement just prior to placing the fresh curb mixture against the previously constructed curb to insure a continuous bond. Joints that are not smooth and uniform, exhibit distortion, or are patched will be rejected.

END OF SECTION

SECTION 32 1813.10

SYNTHETIC GRASS SPORTS SURFACING – RESILIENT PAD

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Synthetic grass sports surfacing underlayment resilient pad intended for use as an underlayment for a short pile synthetic turf, intended for use for High School level Soccer and Football athletic uses.

2. Coordination and integration with Specification Section 32 1813 – Synthetic Grass Surfacing

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. Specification Section 32 1813 – Synthetic Grass Surfacing

C. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

D. State of Connecticut.

1. Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, 2004 and any supplements.

E. American Association of State High and Transportation Officials (AASHTO).

1. AASHTO M252 - Standard Specification for Corrugated Polyethylene Drainage Pipe

F. American Society for Testing and Materials (ASTM)

1. ASTM C88 - Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

2. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

3. ASTM D422 - Standard Test Method for Particle Analysis of Soils.

4. ASTM D696-03 – Standard test method for coefficient of linear thermal expansion of plastics.

5. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3(2,700 kN-m/m3)).

6. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).

7. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

8. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

9. ASTM D3385 - Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer.

10. ASTM D3574 – Standard Test Method for Flexible Cellular Materials

11. ASTM D3575 – Standard Test Method for Flexible Cellular Materials made from Olefin Polymers - Compression Strength

12. ASTM D3786 - Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method.

13. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.

14. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

15. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

16. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

17. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

18. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.

19. ASTM D7001 - Standard Specification for Geocomposites for Pavement Edge Drains and Other High-Flow Applications.

20. ASTM G22-76 - Bacterial Resistance

21. ASTM G21-96 Fungal Resistance

22. ASTM F925 – Chemical Resistance

1.3 SUBMITTALS

A. Sampling and Testing Laboratory: Submit name and qualifications of commercial sampling and testing laboratory for Engineer's approval.

B. Surveyor: Submit name and qualifications of Professional Land Surveyor who will be responsible for layout and verification of the work of this Section.

C. Qualifications: Submit installer's qualifications, including list of projects completed in the past 24 months, for installation of a similar Resilient Pad.

D. Product Data: Submit manufacturer's product data for the Resilient Pad demonstrating compliance with this specification. Include manufacturer's written instructions and procedures for each product.

E. Confirmation of Acceptance, Design: Submit a signed written statement signed by the manufacturer of the synthetic grass surfacing materials confirming that:

1. The field subdrainage system design meets the requirements of the synthetic grass sports surfacing and resilient pad manufacturer and that if the system is constructed as designed there will be no conflicts with the conditions of the warranty.

F. Material Testing Data: Submit for approval test results for all material testing performed under Article 1.5 "Testing, Pre-Construction" herein.

G. Samples

1. Resilient Pad Turf Drainage System: Submit three (3) 12-inch by 12-inch samples.

H. Warranties: Submit copies of warranties in Owner's name for all products furnished under this section.

I. Quality Control Testing Results

1. Submit results of all test results performed under Article "Testing, Quality Control During Construction" herein. Provide copies of all Testing Agency reports.

J. Progress Survey: Submit Progress Survey prepared by Professional Land Surveyor for review by Engineer and turf installer.

K. Confirmation of Acceptance, Completed Base: Submit a signed written statement signed by the manufacturer of the resilient pad and synthetic grass sports surfacing materials and countersigned by the resilient pad and synthetic grass surfacing materials installer (if different), confirming that:

1. Based on the Progress Survey and visual inspections, all applicable areas and surfaces are satisfactory for the installation of the resilient pad and synthetic turf surfacing material.

2. No conditions exist that conflict with the resilient pad and synthetic grass surfacing material warranty requirements.

1.4 DELIVERY, STORAGE AND HANDLING

A. Resilient Pad

1. Follow manufacturer's recommendations for packaging, transportation, and delivery to ensure materials are not damaged. Furnish materials in wrapping that protects the material from ultraviolet radiation and from abrasion due to shipping and hauling.

2. Materials shall be stored on a prepared surface. Protect materials from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or cold, or other damaging circumstances.

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 this Section.

B. Surveys: Provide Progress Survey and As-Built Survey as specified herein.

C. Drainage Test, Pre-Construction

1. Construct a minimum 15-foot by 15-foot (15 ft x 15 ft) sample panel of the complete field subdrainage system (Geotextile, Field Base Bottom Stone, and Resilient Pad) on top of a prepared subgrade section in an area approved by Engineer.

2. Field subdrainage system sample panel shall be complete and in-place, representative of final construction per the Drawings and Specifications. Material testing and compaction testing on the sample panel shall be submitted to confirm the sample panel conforms to the drawings and specifications.

3. Perform an infiltration test, double-ring infiltrometer ASTM F1551/EN 12616 - Standard Test Method for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials, on the completed sample panel (Field Base Bottom Stone layer and Resilient Pad). Alternative infiltration testing will not be considered valid.

a. Testing criteria: The mock-up complete field subdrainage system panel will be considered acceptable when an infiltration rate of no less than 20 inches per hour (20 in/hr) is demonstrated.

4. Sample panel may be utilized as part of the final work.

D. Resilient Pad Drainage

1. Perform infiltration tests, double-ring infiltrometer, ASTM F1551/EN 12616 - Standard Test Method for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials, as the resilient pad layer of the field subdrainage system/base is completed. Alternative infiltration testing will not be considered valid.

2. Testing Frequency: Perform one test for each 25,000 square feet (25,000 sf) of completed area.

3. Testing criteria: Each test will be considered acceptable when an infiltration rate of no less than 20 inches per hour (20 in/hr) is demonstrated. Do not proceed with installation of subsequent layers until all tests are considered acceptable.

4. Surface Regularity:

   a. The planarity of the finished grade of the field resilient pad shall conform to EN 13036 Surface Planarity as performed by an independent Certified Testing Agency.

1.6 WARRANTY

A. The Contractor shall provide a non-prorated Resilient Pad Manufacturer/Installer Warranty/Guarantee (also referred to herein as the Warranty) for the resilient pad materials and installation as specified herein, for a minimum non-pro-rated period of sixteen (16) years to the Owner from the date of Certificate of Substantial Completion.

   1. The Warranty shall cover, in general, the usability of the Synthetic Grass System (and pad); accessories, use, characteristics, and suitability, of the installation to the minimums specified in this Section.

   2. All items covered by the warranty are to be replaced or repaired with new materials, including installation at the sole expense of the warranting manufacturer/surface supplier over the life of the Warranty.

B. Field Use: The resilient pad materials shall be guaranteed for the designated uses as follows:

   1. Football, Rugby, Soccer, Baseball, Softball, Field Hockey, Lacrosse
   2. Marching Band
   3. Graduations and Ceremonies
   4. Physical Education exercises and activities
   5. Pedestrian traffic and other similar uses
   6. Pneumatic rubber tired maintenance and service equipment, designed for use on athletic fields and golf courses.

C. Warranty documents and terms of Warranty shall be in accordance with this Specification.

   1. The use of the Manufacturers' standard or modified form of Warranty shall in no circumstance supersede the conditions set forth in this Specification Section, which shall be considered part of the Warranty.

D. This Warranty shall constitute a contract made in the State of where the project is located and shall be governed by the laws of that State.

E. Warranty shall include coverage for the following

   1. Drainage issues, or Failure to drain at rate of 20" per hour or greater.

   2. Undulations or heaving repair for any undulation caused by the padding material apparent in the turf over ½" in vertical height, whether periodic (due to weather) or persistent.

3. Persistent depressions, or deformation of the pad material ½" or greater caused by the resilient pad materials.

4. Any failure in the physical properties of the pad that negatively affect the aesthetics, playability, G-Max rating or longevity of the synthetic turf of the athletic field.

5. Costs for repair or replacement of the synthetic turf and infill above resilient pad in affected areas in the event of product failure.

F. Warranty shall cover the following:

1. The Contractor to return to the site once (1) per year for the duration of the synthetic turf warranty, no less than 8 visits.

2. The Contractor shall inspect and repair any areas of concern caused by the resilient padding system under warranty during each visit including, but not limited to, the following:

a. Drainage Issues

b. Base Depressions and Undulations Repair

3. Test results, field repairs, and field concerns shall be submitted to the Owner and the Engineer in a Field Inspection Report and Testing Results for review.

PART 2 PRODUCTS

2.1 RESILIENT PAD

A. Commercially-available panelized/modular resilient pad system designed for multi-sport uses. Resilient pad shall consist of pre-fabricated, interlocking, or sewn units configured for installation beneath synthetic turf systems.

1. Panel Drainage Characteristics: Permeable, vertical drainage. Minimum vertical drainage rate: 50 inches per hour.

2. Compatibility: Resilient pad shall be compatible with the submitted synthetic grass surfacing, and the grass surfacing and pad shall provide an acceptable system. Resilient pad shall be in all ways compatible with the specified grass surfacing, and shall not affect the turf warranty, as well as the grass surfacing submitted shall not affect the pad warranty. Pad shall be intended for installation on a stone base without the use of adhesives.

3. Load Capacity: No permanent deformation under periodic loading (e.g. grooming equipment, or ambulance).

4. Connectors, couplers, and other fittings: As required to complete the system and prevent heaving buckling or movement of the mat. Material of construction and configuration shall be in accordance with the resilient pad manufacture's requirements or recommendations, whichever is more stringent.

5. Warranty: Minimum 16 year manufacturer's warranty.

6. Resilient pad performance requirements:

Resilient Pad

Characteristic	Testing Method	Requirements
Material	PVC/Nitrile Rubber Or Expanded Polypropylene	
Material Thickness	17 mm (0.66 inch) +/-0.18"	
Format / Type	Sheet - or interlocking panels	
Drainage / Permeability	BS 7044 Method 4 or EN 12616 as applicable	Perforated or Permeable 50 inches per hour minimum
GMAX, With Turf and infill	ASTM D2859	90 minimum, 120 maximum. (throughout warranty period)
Impact Attenuation, Head Injury Criteria (HIC) (with pad)	EN 1177	<900 @1.4m (throughout warranty period)
Material Density	ASTM D 1056-07	3.6 to 12.5 lbs/ft3
Water Absorption	ASTM D 1056-07	<5%
Vertical Deformation w/out turf	EN 14809	4mm maximum
Thermal Expansion (per 1°C)	ASTM D696-03	0.0000833mm/mm
Compression Strength	ASTM D3575	@25% 30 psi @50% 49 psi @75% 102 psi
Compression Set – Static Load (25% strain, 22 hrs, 23°C after 24 hrs)	ISO 1856C	8.2% (0.089 in) max
Compression Set – Repeated impacts (106 psi, repeated, 10,000 cycles)	System Test	6.0% maximum
Friction Coefficient	ISO 8295	2.44 lbs Max 1.35 lbs average
Microbiological Analysis Bacteria Resistance, Fungal Resistance Chemical resistance	ASTM G22-76 ASTM G21-96 ASTM F925	No growth or detrimental effects
Accelerated Aging 20 yr model - % tensile strength loss 20 yr model - % elongation loss		-<10% after 120 days @ 85C -<5% after 120 days at 85C

7. Manufacturer shall provide documentations that the resilient pad meets the following:

    a. Product meets human health and total threshold limit concentrations using EPA method 3052

b. Product meets human health and total threshold limit concentrations for Title 22 (CAM 17) metals using EPA 6020/7471A and hexavalent chromium using EPA method 7196A.

2.2 GEOTEXTILE

A. Refer to Section 31 2543 - Geotextiles.

2.3 ADHESIVES AND ACCESSORIES

A. Per manufacturers recommendations based on submitted Pad Type.

PART 3 EXECUTION

3.1 GENERAL

A. Notify "Call-Before-You-Dig" to request a utility mark-out for the Project Site prior to any earth disturbance. Provide written confirmation to Engineer that such mark-out has been completed.

B. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any discrepancies or hazardous conditions.

C. Take precautions for preventing injuries to persons or damage to property in or about the work. Protect structures, utilities, adjacent athletic facilities, walks, pavements and other improvements from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

D. Protect sub-grades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

E. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 SURVEYS

A. Documentation

1. As work progresses, record the following on two (2) sets of Drawings:

2. All changes and deviations from the design in location, grade, size, material, or other feature as appropriate.

3. Any uncharted locations of utilities or other subsurface feature encountered during installation, including the characteristics of such uncharted utility or subsurface feature such as utility type, size, depth, material of construction, etc.

4. Recording of changes shall be clearly and neatly marked in red pen or pencil. All changes shall be noted on the appropriate Drawing sheets.

B. Progress Surveys

1. Retain and pay for the services of a Professional Land Surveyor who will be responsible for the verification of the work of this Section. Complete Progress Surveys for:

a. Completed subgrade elevations.

b. Field subdrainage system elevations and drain locations, including all collector piping and drainage system components.

2. Conduct Progress Surveys to verify that the specified lines, grades, and cross sections of the project elements and/or systems as indicated on the Drawings have been achieved, or that the lines, grades, and cross sections of the system required to achieve final field elevations indicated on the Drawings have been achieved.

3. Prior to turf installation, prepare Progress Survey depicting the area and elevations of each finished system for review by Engineer and turf installer. Drawing shall be prepared based on a 20 foot grid with spot grades to the nearest 0.01 foot. In addition to spot grades, Contractor shall pull string lines at each inlaid line location and at 15 foot intervals to identify high and low spots. This includes all lines. Depict locations of string lines on Progress Survey.

4. Tolerance: Correct grades that deviate more than 1/4-inch from required elevations.

C. As-Built Survey

1. Retain and pay for the services of a Professional Land Surveyor who will be responsible for the documentation of the completed work of this Section. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction.

2. Provide to Owner record plans/as-built drawings depicting the completed work. Such record plans/as-built drawings shall be signed and sealed by a Connecticut-Licensed Land Surveyor.

3.3 SUBGRADE

A. Formation: Form and shape subgrade to the specified lines, grades, and cross-sections indicated on the Drawings, or to the lines, grades, and cross-sections required to achieve final field elevations indicated on the Drawings. Refer to Section 31 2310 - Earthwork.

B. Approval of Drainage Stone Base: Examine the drainage stone of the field for horizontal and vertical conformance, compaction, and general suitability.

1. Evidence of inadequate subgrade shall be brought to the immediate attention of Engineer.

2. Surface Regularity:

a. The planarity of the finished grade of the field subdrainge system, prior to installation of the resilient pad, shall conform to EN 13036 Surface Planarity as performed by an independent Certified Testing Agency.

3.4 RESILIENT PAD SYSTEM

A. General: Prior to installation of pad system, confirm manufacturers approval of field base per Sections, 1.3K and 3.3 B. of this specification.

B. Resilient Pad

1. Prior to pad installation pad installer /manufacturer shall provide written acceptance of the prepared subgrade material and surface.
2. Install Pad loose laid on gravel base in accordance with manufacturer's requirements.
3. Protect panels from damage or movement during the installation process. Damaged panels shall be rejected. Install panels and cover with turf promptly. Do not leave panels exposed overnight without ballasting. Contractor is responsible for material stability during construction and shall take all measures necessary to avoid shifting or displacement due to construction, weather or temperature changes.
4. For urethane pads, rolls or sheets; all joints between sections shall be sewn or glued (with backer strip) in the field per manufacturer's instructions. For panelized systems, a interlocking panel design shall be used to hold adjacent panels in place.
5. Pads shall be cut and fit tightly to the edges of the field and all objects within the field. No gaps in the pad over ¼" are acceptable. Use largest size possible. Filler strips or piecemeal work are not acceptable.
6. Grade and planarity of installed Pad system shall comply with Section 1.4, D, 2 (surface planarity) of this specification.

3.5 DRAINAGE TESTING

A. Complete post-installation drainage testing of the installed field subdrainage system/base in accordance with Article 1.7.

3.6 CLEAN UP

A. Contractor shall remove all debris, residuals, and materials at the conclusion of the work.

B. Contractor shall clean up, remove and dispose of all displaced or windblown materials.

END OF SECTION

SECTION 32 9211

SYNTHETIC GRASS SPORTS SURFACING WARRANTY AND GUARANTEE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Synthetic Grass Sports Surfacing Warranty and Guarantee.

1.2 SIGNATORIES TO THE WARRANTY

A. The Synthetic Grass System Warranty shall be signed by:

1. An officer of the applicable party or agency duly authorized to sign contracts. The term "Contractor" specified herein shall refer to the party or agency that is furnishing the warranty.

a. If the grass Manufacturer and/or Installation Contractor of the Synthetic Grass System (referred to herein as the Sub-contractor) is not the same entity as the Contractor, the warranty shall be co-signed by the Manufacturer and the Sub-contractor.

b. "Owner" is the Town of Avon.

1.3 GENERAL WARRANTY CONDITIONS

A. Warranty Period: The Contractor shall provide a non-prorated Synthetic Turf Manufacturer/Installer Warranty/Guarantee (also referred to herein as the Warranty) for the synthetic grass as specified herein, for a minimum period of eight (8) years to the Owner from the date of Certificate of Substantial Completion (unless a leasing program is entered into. If so, the warranty shall be for the period of the lease).

1. The Warranty shall cover, in general, the usability of the Synthetic Grass System (and pad if required); accessories, use, characteristics, and suitability, of the installation.

2. All items covered by the warranty are to be replaced or repaired with new materials, including installation at the sole expense of the warranting manufacturer/surface supplier over the life of the Warranty.

B. Field Use: The field materials shall be guaranteed for the designated uses as follows:

1. Football / Rugby / Soccer

2. Baseball/Softball (including metal cleats)

3. Field Hockey

4. Lacrosse

5. Marching Band

6. Graduations and Ceremonies

7. Physical Education exercises and activities

8. Pedestrian traffic and other similar uses

9. Pneumatic rubber tired maintenance and service equipment, designed for use on athletic fields and golf courses.

C. Warranty documents and terms of Warranty shall be in accordance with this Specification Section.

1. The use of the Manufacturers' standard or modified form of Warranty shall in no circumstance supersede the conditions set forth in this Specification Section, which shall be considered part of the Warranty.

D. This Warranty shall constitute a contract made in the State of Connecticut and shall be governed by the laws of that State.

1.4 PRE-COMPLETION SUBMITTALS

A. Provide prior to Substantial Completion, the following documents:

1. Manufacturer's Sample Warranty: shall be a minimum eight (8) year non-prorated Synthetic Turf Warranty (unless a leasing program is entered into. If so, the warranty shall be for the period of the lease), as specified herein, for the specific type of synthetic grass that the Contractor intends to install on this Project.

2. Financial Warranty: Provide in writing from the Contractor's Insurance Agency, that the Insurance Agency intends to provide the Contractor either a Three-Year Maintenance Bond or Third-Party Insurance Policy, as specified herein, for this Project.

3. Manufacturer's Warranty Certificate, noting compliance with all the conditions of this Specification.

4. Written proof of A.M. Best Rating, as specified herein, for Third-party Insurers affording coverage.

5. Certificate of Liability Insurance (also referred to herein as the Insurance Certificate) – applicable to Financial Warranty as specified herein.

6. Copy of Insurance Policy between the Third-party Insurer and the Synthetic Turf Manufacturer – applicable to Financial Warranty as specified herein.

1.5 CONTRACTOR'S LIABILITY

A. General: Failure to service the requirements of the Warranty will be charged to the Contractor.

B. Repair and Replacement: Any defects caused by delaminating, peeling, normal abrasion or raveling that is not in original conformance with the testing specifications shall be repaired or replaced at no cost to the Owner during this Warranty period.

C. The Contractor will be responsible for all tests, as specified herein, that fail the requirements of the Synthetic Grass System Warranty/Guarantee.

D. Limited Liability: This warranty does not cover excessive wear of the surface caused by misuse. The Owner will be given instructions and care-taking procedures before final acceptance. The Owner is to follow the maintenance guidelines as specified by the surfacing manufacturer.

1.6 GENERAL FORM OF WARRANTY OF THE SYNTHETIC GRASS SYSTEM

A. Warranty form: Sample form of warranty herein set forth is a suggested for use for the work under this section. Manufacturers' standard form of warranty may be used or modified provided conditions specified herein are incorporated.

B. Contractor hereby warrants to the Owner, subject to the limitations and conditions set forth below, that its synthetic grass system consisting of the synthetic grass described as _____, the shock-absorbing under-pad (if necessary) described as _____, and the adhesives used in the installation, are free from defects in material and workmanship and shall, for a minimum period of eight (8) years from the date of acceptance by the Owner, remain serviceable for the activities as listed above.

C. Contractor warrants to the Owner that its synthetic grass materials shall not fade, fail, shrink, wrinkle or reflect excessive wear. Contractor shall, at their sole expense and cost, replace such areas of the synthetic grass system not performing to these standards for the life of the warranty.

1. The term "not fade" in the context of this warranty shall mean that the synthetic grass material remain a uniform shade of green or the other colors installed with no significant loss of color as defined by not greater than 20% loss or shade reduction.

2. The term "not fail" or "excessive wear" as used in the context of this warranty shall mean that the length and weight of the face yarn or pile material in the synthetic grass surface shall not have been decreased by more than 6% per year according to ASTM D418, nor exceed 20% during the warranty period.

D. In the event that the synthetic grass materials do not retain its fiber height or shock absorbency and is consequently no longer serviceable during the warranty period, the Contractor shall, at their sole expense, replace such portions of the system that are no longer serviceable.

1. The term "serviceable" in the context of this warranty shall mean that the synthetic grass material shall have a maximum '"G" force value according to Procedure A, B, or C of ASTM D355, not exceed 120 G's at any location upon installation and shall not exceed 160 G's thereafter throughout the life of the warranty period. This shall be determined by conducting dynamic cushioning tests at the 10 field locations as required per ASTM D355 procedures. "G" force factor values to be determined at 70 degrees F.

a. Any increase from 120 G's to allowable 160 G's maximum shall be at a relatively uniform rate not to exceed 10 G's in any single year. Individual "G" testing below 95 "G's" shall not be allowed in the total averaging of the G-max testing.

b. Prior to any G-Max testing on the field, the testing machine shall be calibrated in the field with a test pad to verify accuracy of the testing unit. Calibration and testing shall be witnessed by the Owner or Owner's representative. The Contractor is required to perform the necessary testing during a scheduled time at least one time per year during the Warranty period. The results of the testing shall be submitted to the Owner within 30 days of each test. Failure to submit the results shall serve as notice to perform such testing by Owner to determine the extent of the needs under this Warranty.

E. Where applicable, the fabric shall adhere firmly and completely to the under-pad or seaming tape over the entire warranty period.

F. Contractor warrants to the Owner that the permeable synthetic grass system shall drain vertically a minimum of 10 inches precipitation per hour for a maximum of 24 hours continuously, without visible surface ponding.

G. Contractor shall replace with new materials, at their sole expense, any damage to the synthetic grass system, which extends more than one meter beyond the location of foreign combustibles, which may ignite, and fire-damage the synthetic grass system. The Contractor shall not be held responsible for any incidental or consequential damages. These warranties and the Contractor's obligations here-under are expressly conditioned upon;

1. The Owner making all minor repairs to the synthetic grass system upon the discovery of the need for such repairs.

2. The Owner maintaining and properly caring for the synthetic grass system in accordance with the Contractor's maintenance manual and instructions.

3. The Owner complying with the dynamic and static load specifications established by the Contractor.

H. The warranty is not to cover any defect, failure, damage or undue wear in or to the synthetic grass system caused by or connected with abuse, neglect, deliberate acts, acts of God, casualty, static or dynamic loads exceeding Contractor's recommendations.

1.7 FINANCIAL WARRANTY

A. General: In addition to the Manufacturer's Warranty specified herein, the Contractor shall submit one of the following options to the Owner in regard to the Financial Warranty, prior to final payment.

B. Third-party Insurance Policy: The Third-party Insurance Policy (referred to herein as the Insurance Policy) shall be pre-paid for the entire (8) eight-year period (unless a leasing program is entered into. If so, the warranty shall be for the period of the lease)., without exceptions and must have the following policy features:

1. Insurance Policy shall be issued by a reputable third-party insurer with an A.M. Best financial strength rating of "Excellent" or A-.

2. Insurance Certificate shall name the Owner shall as an additionally insured party. Insurance Policy coverage shall specifically provide for reimbursement to the warranty holder and/or the Owner of the turf system installed, in the event of a bankruptcy of the Synthetic Turf Provider.

3. Insurance Certificate shall note that insurance coverage applies to the full eight (8) year period (unless a leasing program is entered into. If so, the warranty shall be for the period of the lease).from the date set by the Certificate of Substantial Completion. Insurance coverage shall have no uninsured periods or periods of self-insurance.

4. Insurance Certificate shall note that insurance coverage offers a minimum claim limit of $300,000 per field of 100,000 square feet or less – to be noted in the Insurance Certificate.

Larger field areas or multiple fields shall be separately insured under the same terms of this specification.

5. Insurance Certificate shall note that insurance coverage offers a minimum claim limit of $5,000,000 in the aggregate per annum.

6. Insurance Policy coverage shall not have exclusions for epidemic or catastrophic failure.

7. Insurance Policy coverage shall not limit the hours of use.

8. Insurance Policy coverage shall not exclude heavily trafficked areas or related uses such as team practices, band practices or multiple sports use.

9. Insurance Policy coverage shall apply to playing surface inclusive of the infill, seaming, labor, colored inlays, logos, lettering, numbers, and event markings.

1.8 WARRANTY INSPECTIONS AND TESTING

A. Scheduled Inspection and Testing: Contractor shall examine the synthetic grass surfacing system and conduct testing and maintenance on the synthetic grass surface as a part of a warranty maintenance plan, see paragraph 1.10 “Warranty” in Specification Section 32 1813 – Synthetic Grass Surfacing and paragraph 1.11 “Warranty and Maintenance Obligations” in Specification Section 32 1813 – Synthetic Grass Surfacing.

1. The Testing Results and Field Inspection Report shall be delivered to the Owner and Engineer within thirty (30) days of the testing.

B. Other Inspections: Contractor shall examine the synthetic grass system in regard to any claim that the Owner makes to be present at any time, to analyze the results of all tests conducted by the Owner or Owner’s Authorized Representative(s), and to conduct such tests of his own on the synthetic grass surface.

1. The Owner reserves the right to submit on the synthetic grass surface to the above tests at any time during the length of the Warranty. Consideration will be given to the age and intensity of use of the surface.

C. Cost of Inspections: The Contractor shall pay for costs of scheduled inspections, testing, and analysis.

1.9 REMEDIAL WORK

A. Notice: The Owner will notify the Contractor in writing of any issues that require remedial work on the field area.

1. The Contractor shall respond to the notification within forty-eight (48) hours of receipt and schedule any major defect or repair within seventy-two (72) hours or as weather permits.

2. In the event the Contractor does not respond to the Owner’s written notice within ten (10) days of receipt of the notice or does not submit, schedule and execute corrective work within sixty (60) days, weather permitting, the Owner has the option of having the work performed at the expense of the Contractor.

3. The Contractor will be given seven (7) days notice in the form of a certified letter notifying the Contractor of the end of the sixty (60) day period.

B. Repairs: The Warranty requires that the Contractor shall be required to perform all required repairs in a permanent and suitable manner as deemed necessary to maintain a safe playing condition at all times.

1. Any replacement or repair area shall match (as close as possible) the appearance of the existing grass.

C. Schedule of Repairs: The Warranty requires that in case of any major repair or replacement, the Contractor is to schedule such work as to not interfere with the Owner's primary use or schedule.

1.10 CLAIMS

A. All claims by the Owner under this Warranty must be made in writing to the Contractor's address, Within 30 days after the Owner learns of the defect, giving rise to the claim.

END OF SECTION

SECTION 32 18 13

SYNTHETIC GRASS SPORTS SURFACING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Procurement and installation of synthetic grass sports surfacing.

2. Procurement and installation of coated sand infill.

3. Pre and post installation testing of synthetic grass sports system.

4. All incidental work items required to complete the work as shown on the Drawings and as called-for in the Specifications.

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work. Carefully examine all of the Contract Documents for requirements which affect the work of this Section. The exact scope of work of this section cannot be determined without a thorough review of all Specification Sections and other Contract Documents.

C. In all cases when conflicts exist between information contained in this Section and in other parts of the Contract Documents, Contractor shall assume that the more stringent and highest-performing solution is required.

D. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. State of Connecticut.

1. Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, 2004 and any supplements.

D. ASTM International (ASTM)

1. ASTM D 1335 - Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings.

2. ASTM D 1577 - Standard Test Methods for Linear Density of Textile Fibers.

3. ASTM D 2256 - Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method.

4. ASTM D 2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.

5. ASTM D 3218 – Standard Specification for Polyolefin Monofilaments.

6. ASTM D 3776 - Standard Test Method for Mass per Unit Area (Weight) of Fabric.

7. ASTM D 3786 – Standard Test Method for Bursting Strength of Textile Fabrics: Diaphragm Bursting Strength Tester Method.

8. ASTM D 4491 - Water Permeability of Geotextiles by Permittivity.

9. ASTM D 4533 - Trapezoid Tearing Strength of Geotextiles.

10. ASTM D 4833 - Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

11. ASTM D 5034 – Standard Test Method for Breaking Strength and Elongation of Textile Fabric (Grab Test).

12. ASTM D 5035 – Standard Test Method for Breaking Force and Elongation of Textile Fabric (Strip Method).

13. ASTM D 5199 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.

14. ASTM D 5793 – Standard Test Method for Binding Sites per Unit Length of Width of Pile Yarn Floor Coverings.

15. ASTM D 5823 – Standard Test Method for Tuft Height of Pile Floor Coverings.

16. ASTM D 5848 – Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Coverings.

17. ASTM D 7138 – Standard Test Method to Determine Melting Temperature of Synthetic Fibers.

18. ASTM F 355 - Standard Test Method for Impact Attenuation of Playing Surface Systems and Materials.

19. ASTM F 1015 – Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces.

20. ASTM F 1551 - Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials (for those not covered above).

21. ASTM F 1632 - Particle Size Analysis and Sand Shape Grading of Golf Course Putting Green and Sports Field Rootzone Mixes.

22. ASTM F 1936 - Standard Specification for Impact Attenuation of Turf Playing Systems as Measured in the Field.

23. ASTM F 2117 – Standard Test Method for Vertical Rebound Characteristics of Sports Surface/Ball Systems.

24. ASTM F 2765 - Standard Specification for Total Lead Content in Synthetic Turf Fibers.

25. ASTM F 2898 – Standard Test Method for Permeability of Synthetic Turf Sports Field Base Stone and Surface System by Non-confined Area Flood Test Method.

26. ASTM F 3188 – Standard Specification for Extractable Hazardous Metals in Synthetic Turf Infill Materials.

27. ASTM F 3189 – Standard Test Method for Measuring Force Reduction, Vertical Deformation, and Energy Restitution of Synthetic Turf Systems Using the Advanced Artificial Athlete.

E. European Standards (EN)

1. DIN EN 20105-A02 – Tests for Colour Fastness of Textiles.

2. BS EN 1097-11 – Tests for Mechanical and Physical Properties of Aggregates.

3. BS EN 12616 – Determination of Water Infiltration Rate.

4. BS EN 13036-7 – Test Methods for Irregularity Measurements of Pavement Courses.

5. BS EN 15301-1 – Determination of Rotational Resistance.

F. National Federation of State High Schools (NFHS)

1. Rules Books for High School Sports (Football, Soccer, Boys & Girls Lacrosse) – Current Edition

2. Court and Field Diagram Guide – Current Edition

G. National Collegiate Athletic Association (NCAA)

H. Synthetic Turf Council Guidelines (STC)

1. Guidelines for Maintenance of Infilled Synthetic Turf Sports Fields – Current Edition

2. Guidelines for Synthetic Turf Performance – Current Edition

3. Guidelines for Synthetic Turf Base Systems – Current Edition

I. Connecticut Interscholastic Athletic Conference (CIAC)

J. American Sports Builders Association (ASBA)

1. Sports Fields: A Construction and Maintenance Manual – Current Edition

1.3 DEFINITIONS

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

1. Provide: Furnish and install completely connected up and in operable condition.

2. Furnish: Purchase and deliver to a specific location within the building or site.

3. Install: With respect to equipment furnished by others, install means to receive, unpack, move into position, mount and connect, including removal of packaging materials.

1.4 SUBMITTALS

A. Bid Submittals

1. Non-compliance with the bid submittal requirements as specified herein may result in rejection of the bid.

2. A letter on the synthetic grass surfacing manufacturer/vendor's letterhead shall be submitted, with the bid, confirming their intent to conform to all information presented during the bidding process for the Synthetic Grass Surfacing System. Including, but not limited to, the bid Drawings, Specifications, Addendum, and RFI Clarifications.

3. Synthetic grass surfacing manufacturer/vendor and installer qualifications:

a. Installer Qualifications: Synthetic Grass installation Sub-Contractor shall certify in writing the designated supervisory personnel on the project are competent in the installation of the synthetic grass material, including gluing or sewing seams and proper installation of the infill mixture. The synthetic grass surfacing installer shall have a representative on-site to certify the installation and warranty compliance. Provide experience to show that installation crew is competent to complete the level of work outlined in this project. Synthetic Grass installation Sub-Contractor's superintendent shall experience to demonstrate that the superintendent is competent to oversee and complete the level of work outlined in this project.

b. At a minimum, provide the following documentation: Ten (10) reference projects consisting of Synthetic Grass Multi-Sport Grass Fields of 75,000 square-feet or larger within the past five (5) years

1) Project Information: At a minimum, provide the following information for each reference project:

2) Project Name

3) Project Location

4) Project Scope

5) Construction timeline

6) Synthetic Surfacing Size (square feet)

7) Reference name, title, affiliation, and contact information.

B. Submittals

1. Manufacturer's Review of Synthetic Grass Surfacing

a. Submit written statement, signed by Contractor and synthetic grass surfacing installer stating that the Drawings and Specifications have been completely reviewed by qualified representatives of the materials manufacturer and that they are in agreement

that the materials and system to be used synthetic grass surfacing are proper and adequate for the applications shown and in no way, impact the system warranty.

2. Manufacturer's Review of Synthetic Grass Surfacing Drainage Base Design

    a. Letter indicating that they have reviewed the materials proposed for use in the drainage mat (if applicable), field base stone, perimeter collector drain base stone, and are compatible with the intended use.

3. Product Data

    a. Submit manufacturer's specifications and installation instructions for all products in the Synthetic Grass Surfacing system, including certifications and other data as may be required, to show compliance with the Contract Documents.

        1) Material Safety Data Sheets (MSDS) sheets for all products and product components, as necessary. This shall include solvents and other products required as part of clean-up.

        2) Certified Statement of the presences of toxic and or hazardous materials. Any toxic and/or hazardous material exceeding 100 parts per million (ppm) shall be identified in list form. The list shall reference the standard in name and threshold if applicable, and the test results. This requirement is above and beyond the requirements for MSDS.

4. Material Testing Data: Submit for approval test results for all material testing performed under "Testing, Pre-Construction" herein. Provide copies of all Testing Agency reports.

5. Shop Drawings

    a. It is the Manufacturer's responsibility to supply complete shop drawings, details, and material samples for the system proposed to be installed to the Engineer for review and approval.

        1) Seaming plan; Seams of the field shall not coincide with the subsurface drain system nor seams of pad (if applicable).

        2) Field marking layout, including logos. Layouts for NFHS Football, Soccer, Field Hockey, Boy's Lacrosse, Girls' Lacrosse, showing any field lines, markings, boundaries on the appropriate field(s) and all specified colors. All markings shall be tufted in the factory or inlaid. Provide certification that field layouts meet all CIAC and NFHS sport marking requirements as installed in the field.

        3) Details on field construction, making special note of any details that may deviate from the Drawings or Specifications. Include: edge detail, goal post detail, covers for access to subsurface structures, other inserts, etc.

6. Samples: Submit three (3) samples with testing data for approval for all materials under 2.1 Materials including, but not limited to, the following:

    a. Synthetic Grass Surfacing Fiber: Samples for each color used for the field, markings, and logos.

b. Synthetic Grass Field Sample: Twelve-inch (12") square samples of un-filled Synthetic Grass for each color used for the main field (typically green(s)). The samples shall be reviewed as the product intended for use on the field.

c. Seaming or Sewing Materials: Twelve-inch (12") samples of all materials to be used for seaming or sewing of the synthetic turf system. Include a layout of the system.

d. Synthetic Grass Surfacing infill: One-pound samples of coated sand (in separate bags).

7. Material Certificates

8. Acceptance of prior work letter as described under Article “Examination” herein.

9. Warranties: Submit copies of warranties in Owner's name for all products furnished under this section.

10. Quality Control Testing Results: Submit results of all test results performed under Article “Testing, Quality Control Post Construction” herein. Provide copies of all Testing Agency reports.

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 this Section.

B. The Owner, or Engineer on the Owners behalf, reserves the right to submit any material, either before or after installation, for testing it deems necessary to satisfy the conditions of this contract.

C. Any material tested and found not in compliance with the contract will be rejected and replaced with material conforming to the specifications. This will be done at the sole expense of the Contractor.

D. Any testing performed by the Owner will be at the Owner's expense. The Contractor is responsible for the cost of all testing that fails. Contractor will bear the cost of all retesting as required by the Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Schedule delivery to minimize on-site storage. Segregate differing materials and prevent from contamination with other materials.

B. Packing and Shipping: Deliver products in original unopened packaging with legible manufacturers' identification. All materials shall be stored in a dry place out of the direct sunlight.

C. Prior to the installation of any materials and immediately upon delivery of the synthetic grass system and components to the Project site, the Contractor shall inspect materials as follows:

1. For damaged or defective items.

2. Measure synthetic grass pile height and roll lengths.

3. Inspect the perforations and uniformity.

4. Adhesives shall arrive in sealed dry containers.

5. Coated sand in-fill shall arrive in large sacks or bags without tears and loose material about.

6. Coated sand in-fill shall arrive dry and loose. No infill shall be accepted that is bulked or solid.

7. Coated sand in-fill shall be free of exposed metal particles.

D. Bulk Materials: Deliver materials in clean, washed and covered trucks to eliminate contamination during transportation. On site stockpiling locations to be coordinated with the Owner. Stockpile only in areas free of debris and away from drainage routes. Cover all materials with plastic or geotextile if materials are to be stockpiled more than 48 hours.

1.7 TESTING, PRE-CONSTRUCTION

A. Material Testing

1. All testing shall be completed by an independent (third-party) testing laboratory. Testing must be for current materials with current date from independent testing laboratory.

2. Certified copies of laboratory reports shall be submitted for all testing.

3. Timing: Contractor shall submit to Engineer a copy of all test results certified by the independent testing laboratory prior to shipping the Synthetic Grass Surfacing to the Project Site.

4. All sampling/testing shall be the responsibility of Contractor/Manufacturer. Contractor/Manufacturer shall retain and pay for the services of a third-party Testing Agency to perform all sampling/testing in accordance with applicable standards. Provide testing data for the following:

Synthetic Grass Surfacing System		
Testing Method	**Characteristic**	**Requirements**
ASTM D5283	Pile Height	1.625 inch
ASTM D5793	Stich Gauge	3/8 inch
ASTM D5848	Pile “face” Weight	≥ 50 oz./sq. yd.
ASTM D5848	Total Carpet Weight	≤± 2oz./sq. yd. of specification
ASTM D1335	Turf Bind (without infill)	> 8 lbs. or 30N > 22 lbs.
ASTM D5848	Primary Backing	> 7 oz./yd^2
ASTM D5034	Grab Tear Strength	> 200 lbs.-F

Synthetic Grass Surfacing System		
Testing Method	**Characteristic**	**Requirements**
ASTM D5848	Secondary Backing	> 25 oz./yd^2
Visual	Perforations	Minimum 3/8" dia. Holes, spacing 3"x4" on center maximum
ASTM 2898/EN 12616	Determination of water infiltration rate in laboratory	>16 in/hr.
ASTM F 355	G-max Impact Attenuation (with pad)	< 120 G's
ASTM F1969	Infill Depth Measurement	75% pile height
EN 1177	Impact Attenuation, Head Injury Criteria (HIC) (with pad)	<900 @1.4m
EN 14808	Force Reduction, AAA (with pad)	55% to 70%
EN 14809	Vertical Deformation, AAA (with pad)	4mm to 9mm
EN 15301	Rotational Resistance (with pad)	25 Nm to 50 Nm
Individual Turf Fibers (including each fiber color separately)		
ASTM D789	Melting Point	235 degrees F
ASTM D5034	Breaking Strength	Length 283 lbs./ft. Width 208 lbs. /ft
ASTM D5034	Coefficient of Friction	Dry 1.15; Wet 1.00
ASTM D2859	Pill Burn Test	8 Passed/0 Failed
ASTM D1907	Fiber Denier	≥ 10,000 denier

Synthetic Grass Surfacing System		
Testing Method	**Characteristic**	**Requirements**
ASTM D3218	Fiber Microns	≥ 120 microns (slit-film) ≥ 230 microns (monofilament)
ASTM F2765	Lead Content	≤ 50 ppm
ASTM F1015	Abrasiveness Index	≤35
Infill System		
EN 1969	Infill Depth	75% of Fiber Height
EN 933	Infill Size Gradation (coated sand)	≤± 20% of declaration
EN 14955	Infill Shape (Coated sand)	≤± 15% of declaration
EN 1097	Infill Bulk Density (Coated sand)	≤± 15% of declaration
ASTM F2765	Lead Content	≤ 50 ppm
EN 71-3	Safety of Toys Part 3	Citation that the product complies with the STC's Suggested Environmental Guidelines for Infill

5. Any material tested and found not in compliance with the contract may be rejected and Contractor shall submit a material found to be acceptable.

6. The Owner, or Engineer on the Owner behalf, reserves the right to independently test any material. Any testing performed by the Owner will be at the Owner's expense. The Contractor is responsible for the cost of all testing that fails. Contractor will bear the cost of all retesting as required by the Owner.

1.8 TESTING, QUALITY CONTROL POST-INSTALLATION

A. Material Testing

1. Contractor shall provide, in writing, that the materials installed on-site are those that were submitted and approved under Article "Testing, Pre-Construction".

2. All testing shall be completed by an independent (third-party) testing laboratory.

3. Materials Verification: The following testing must meet the following requirements to confirm agreement with product declaration. Testing will be arranged and paid for by the contractor. Samples are to be taken from the site on 3 rolls / bags per material chosen at random and shipped directly to an approved testing laboratory. Contractor to coordinate with the testing laboratory the quantities of materials needed.

4. Testing Requirement: To be performed on the Synthetic Grass Surfacing upon completion per the standards and requirements below.

5. Certified copies of laboratory reports shall be submitted for all testing.

6. Timing: Contractor shall submit to Engineer a copy of all test results certified by the independent testing laboratory within 5 days after installation.

7. All sampling/testing shall be the responsibility of Contractor. Contractor shall retain and pay for the services of a third-party Testing Agency to perform all sampling/testing in accordance with applicable standards (Contractor shall provide additional material and labor necessary to comply with requirements at no additional cost to the owner). Provide testing data for the following:

Material Verification		
Testing Method	**Characteristic**	**Requirements**
ASTM D1907	Fiber Denier	≤± 10% of specification
ASTM D3218	Fiber Microns	≤± 10% of specification
ASTM D5283	Pile Height	≤± 1/8 inch of specification
ASTM D5793	Stich Gauge	Same as specification
ASTM D5848	Pile Weight	≤± 2oz/sq. yd. of specification
ASTM D5848	Total Weight	≤± 2oz/sq. yd. of specification
ASTM D1335	Turf Bind (without infill)	> 6.8 lbs. or 30N
EN 933	Infill Size Gradation	≤± 20% of specification
EN 14955	Infill Shape	≤± 15% of specification
ASTM D5848	Primary Backing Weight	≤± 10% and no more than minus 2oz/sq.yd. of Specification
ASTM D5034	Grab Tear Strength	> 200 lbs.-F
ASTM D5848	Secondary Backing Weight	≤± 10% and no more than minus 2 oz/sq. yd. of Specification
Visual	Perforations	3/8” dia. Holes, spacing 3”x4” on center maximum
Testing Requirements A (to be submitted within 5 days of installation completion)		
ASTM F 355	G-max Impact Attenuation	< 120 G’s > 90 G’s > 8 lbs

Material Verification		
Testing Method	**Characteristic**	**Requirements**
EN 1969	Infill Depth Measurement (Minimum 40 Locations)	≤± 10% of Specification.
ASTM 2898/EN 12616	Determination of Water Infiltration	>16 in/hr.
EN 13036	Planarity/Surface Regularity	<10 mm difference over 3m straight edge
EN 14808	Force Reduction, AAA	55% to 70%
EN 14809	Vertical Deformation, AAA	4mm to 9mm
EN 15301	Rotational Resistance	25 Nm to 50 Nm
EN 12234	Ball Roll	4m to 10m
EN 12235	Vertical Ball Rebound	60cm to 100cm
Testing Requirements B (to be completed and submitted to the Owner and Engineer annually for the period of the warranty). Any area exceeding the limits of this specification shall be repaired or replaced.		
ASTM F 355	G-max Impact Attenuation (turf and pad)	< 160 G's Max. > 90 G's Min. > 8 lbs
EN 1969	Infill Depth Measurement (40 Locations minimum)	≤± 10% of Specification.

8. The Owner, or Engineer on the Owners behalf, reserves the right to submit any material, either before or after installation, for testing it deems necessary to satisfy the conditions of this contract.

9. Any material tested and found not in compliance with the contract will be rejected and replaced with material conforming to the specifications. This will be done at the sole expense of the Contractor.

10. Any testing performed by the Owner will be at the Owner's expense. The Contractor is responsible for the cost of all testing that fails. Contractor will bear the cost of all retesting as required by the Owner.

1.9 PATENT RIGHTS AND INFRINGEMENT

A. The Drawings and Specifications are not indented to be proprietary or in violation of any current or pending patents. The Contractor and subcontractors are responsible to provide the Owner and Engineer with any violations contained here in prior to bidding. By bidding on the project the

Contractor and subcontractors shall hold the Owner, Construction Manager, Engineer, and Field Consultant harmless from infringement of any current or future patent issued for the synthetic grass surfacing system.

B. Contractor and subcontractors shall hold the Owner, Construction Manager, Engineer, and Field Consultant harmless from infringement of any current or future patent issued for the synthetic grass surfacing system, fibers, backings, including shock pad (if required), installation methods and vertical draining characteristics. The successful bidder will be required to submit a letter for consent from their surety. The Surety shall indemnify the requirements.

C. There are various established performance criteria throughout this request for products and services. There may exist patent coverage for some means and methods of achieving those performance criteria. Bidders are responsible for ascertaining that means and methods of the products and services which they are providing are not being provided in violation of any such patent rights. Bidder's responsibilities are as follows:

1. To hold harmless, the Owner, Engineer, Field Consultant, and the Owner's other consultants, as to any violation to include dollar amounts that could be owed as a result of damages for infringement including potential treble damages as provided for under U.S. Patent Law.

2. Any and all costs that the Owner, Engineer, Field Consultant, and the Owner's other consultants, would incur in replacing materials and services which are determined to infringe patent rights.

3. All administrative, legal and other costs that would be incurred as a result of an infringement.

1.10 WARRANTY

A. The Synthetic Grass Contractor shall be required to provide an Impact Attenuation (G-Max) and In-Fill testing (Testing B) and maintenance plan for the lifespan of the warranty as part of this Contract and shall submit a schedule of visits at the time of completion.

B. See Specification Section 32 1813.20 Warranty.

1.11 WARRANTY AND MAINTENANCE OBLIGATIONS

A. The Synthetic Grass Contractor shall be required to provide an Impact Attenuation (G-Max) and In-Fill testing (Testing B) and maintenance plan for the lifespan of the warranty as part of this Contract and shall submit a schedule of visits at the time of completion.

1. Impact Attenuation (G-Max) and In-Fill Testing (Testing B)

a. The Contractor to return to the site once (1) per year for the duration of the warranty, no less than 8 visits.

b. The Contractor shall inspect and repair any areas of concern under warranty during each visit including, but not limited to, the following:

1) Drainage Issues

2) Nailer Board/Concrete Anchor Cub Repairs

3) Inlays, Numbers, Logo, and Seam Conditions

4) Base Depressions and Undulations Repair

5) Fiber Conditions

6) Fiber Height

7) Infill Height/ Compaction

c. Additional infill may be required by contractor to maintain the G-Max levels and required infill depths.

d. Test results, field repairs, and field concerns shall be submitted to the Owner and the Engineer in a Field Inspection Report and Testing Results for review.

2. Field Warranty Maintenance

a. The Contractor to return to the site twice (2) during the duration of the warranty.

1) (1) Just prior to four (4) years of use

2) (1) No greater than six (6) months and no less than (2) months from the completion of the warranty period.

b. Field maintenance shall be scheduled with the Owner and the Engineer and completed prior to the yearly Impact Attenuation and Infill Testing.

c. Field warranty maintenance shall be performed by a qualified technician and with the use of proper equipment specific to synthetic grass surfacing system.

d. Field maintenance shall include the following on each visit:

1) Grooming to stand turf fibers up

2) Deep de-compaction of in-fill material (this shall also include a tow behind magnet to collect unwanted ferrous materials from with the in-fill). De-compaction shall consist of entire in-fill system to the fiber base/ top of backing. Partial grooming of in-fill material shall not be accepted as a de-compaction. Static brush, spring tine rake, or power grooming are not considered deep de-compaction mechanisms.

3) Power grooming to remove all broken fibers and debris

4) Field sweeping to removal all debris and pollutants from the turf surface

5) Blow and final groom field to ensure fibers are properly standing up. Add additional in-fill to ensure proper and consistent in-fill depth as specified under warranty obligations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Synthetic Grass System

1. All components and their installation method shall be designed and manufactured for use on outdoor athletic fields. The finished playing surface shall appear as mowed grass with no irregularities and shall afford excellent traction for conventional athletic shoes of all types. The finished surface shall resist abrasion and cutting from normal use. The system shall be suitable for football, soccer, lacrosse, field hockey, PE classes, intramurals, and recreational use.

2. The materials as hereinafter specified should be able to withstand full climatic exposure in all climates, be resistant to insect infestation, rot, fungus, mildew, ultraviolet light, heat degradation, and be non-allergenic and non-toxic. The entire system shall be constructed to maximize dimensional stability, to resist damage and normal wear and tear from its designated uses and to minimize the ultra-violet degradation.

3. The system shall have the basic characteristics of flow-through drainage, allowing free movement of surface runoff through the synthetic grass system where such water may flow to the stone base and into the field drainage system. The final coating shall be a polyurethane based material.

4. The polyethylene parallel long-slit-film pile yarn shall be a proven athletic caliber yarn designed specifically for outdoor use and stabilized to resist the effect of ultraviolet degradation, heat, foot traffic, water, and airborne pollutants.

5. All adhesives used in bonding the system together shall be resistant to moisture, bacterial and fungus attacks, and resistant to ultra-violet rays at any location upon installation.

6. The fibers are tufted through a triple layer (three separate layers) referred to herein as the Primary Backing, Intermediate Layer, and Secondary Backing.

7. The Primary Backing and Intermediate Layer shall be a combination of woven and/or non-woven synthetic backing material. Action backs shall have no more than a 1/8" mesh.

8. The Secondary Backing shall be moisture cure polyurethane. This backing shall not be less than 20 ounces. The polyurethane coating for the Secondary backing shall be uniform and monolithic when cured.

9. All synthetic grass surfacing seams shall be sewn with high strength polyester fiber cord. Sewn seams shall be a butt-sewn with double loop lock stitch. Seams shall lay flat after in-fill. Bagger type seam stitching is not permitted.

10. All glued inlays shall have a 12" wide seaming tape of nylon or mylar, fully coated with adhesive. All inlays shall not have any adhesive applied to any exposed fibers. All graphics or markings can be tuft-in or cut-in (shaving is not permitted).

11. Fabric surface shall be constructed and installed in minimum widths of 15 feet with no longitudinal or transverse seams, except for inlaid lines with a finished roll assembly.

12. The seams shall be 15'-0" apart. No fitted pieces shall be allowed to true alignment.

13. The Synthetic Grass System shall remain free draining at all times before, during, and after the infill materials are installed.

B. Synthetic Grass Fibers

1. Pile fibers shall resemble freshly grown natural grass in appearance, texture and color (except for the colored synthetic grass for markings). Streaks, discoloration, or different dye lots shall not be accepted.

2. Fibers shall be a blend of 50% parallel slit film fiber (100% Polyethylene fiber having a denier of not less than 10,000 with a film thickness of not less than 110 microns) and 50% monofilament fiber (100% Polyethylene fiber having a denier of not less than 10,000 with a film thickness of not less than 230 microns). C-Shaped Monofilaments are not acceptable. Total fiber weight shall be as specified herein. Fibers shall be consistent throughout the field, including colored markings and logos. Mono-ribbons are not acceptable.

3. Manufacturer is to guarantee that the synthetic grass fiber is adaptable to painted lines.

4. Acceptable Synthetic Grass Fiber manufactures include:

   a. Bonar Yarns

   b. Radici Group Yarn

   c. Tencate Grass Yarn

   d. ITS

   e. FieldTurf

   f. Equal Products only as approved by Engineer

5. The list of acceptable Synthetic Grass Fiber manufactures is provided for general approval of product line only. Submittals, as specified herein, are required without exception. The Contract Specifications shall supersede product literature from the approved acceptable Synthetic Grass Fiber manufactures listed.

6. Submittals for equal product approval shall be submitted to the Engineer for pre-qualification prior to bidding. The pre-qualification submittal shall include all of the submittal requirements required within this specification section except the logo colors and seaming diagram which shall be submitted later as specified. Submittal of product approval does not guarantee acceptance as an equal.

C. Markings and Logos

1. All field lining, marking, field boundary system with team area limits, logos, etc. shall be same material (fiber, infill, and backing) as playing field system.

2. Lines, logos, and graphics to be installed on the synthetic grass surface as per documents are to be tufted in the factory to the maximum extent practical. Those not tufted in the factory shall be inlaid in the field.

3. A complete field lining, marking, and field boundary system with team area limits, etc. shall be provided with the initial installation. Layouts shall be accurately surveyed and marked prior to installation. Layouts shall include all incidental markings required by the NFHS, CIAC or UIL, whichever is applicable.

4. All markings shall be uniform in color, providing a sharp contrast with the synthetic grass color and shall have sharp and distinct edging.

5. All logos are to be tufted or inlaid (shaving is not permitted) with the specific colored synthetic grass. All logos shall be uniform in color, providing a sharp contrast with the synthetic grass color and shall have sharp and distinct edging. Logos shall be true and shall not vary more than 1/2" from specified width and location.

    a. Provide one (1) three color center logo “A” and field graphics as shown on the Drawings.

        1) Color: As shown on the drawings.

    b. Provide the following text “Avon” in each end zone as shown on the Drawings.

        1) Color: As shown on the Drawings.

D. Adhesive Materials and Seaming Tape

1. Adhesive material to fix the synthetic grass system to the seaming tape shall be a polyurethane adhesive:

    a. NORDOT Adhesive by Synthetic Surfaces Inc.

    b. Turfbond Synthetic Turf Adhesive

    c. Mapei Ultrabond Turf PU Single Component Adhesive

2. If a hot melt welding method is used, the glue shall have an application temperature of 325 degrees F. with a melting point of 180 degrees F. Material shall be National Adhesive #34-5372 or equal. Submission of all hot melts shall be 10 calendar days prior to installation.

3. Bonding surfaces shall be clean, dry, and free from grease, oil, wax, weak oxide films, mold release agents, and other surface contaminants.

4. The adhesive shall be applied at the rate not to exceed 60 square feet per gallon.

5. The adhesive shall have the same warranty period as the synthetic grass system.

6. Seaming tape shall be a 12" wide polypropylene or polyethylene fabric acceptable for use with the synthetic turf carpet system and the adhesive material.

7. Seaming tape shall meet FIFA Joint Strength >25N/100mm

E. Infill

1. Infill Materials shall be uniformly filled to a depth which is 75% of the total pile height after settlement.

2. Infill materials shall consist of green acrylic coated sand. The synthetic turf infill material shall be specifically designed and manufactured for athletic use. It shall be a rounded and highly uniform quartz sand pigmented and sealed with an acrylic polymer and have the following properties:

    a. The silica sand shall have greater than 95% of particles retained on the U.S. standard 12-20 mesh sieve.

    b. Bulk Density: >100 lbs./Cu. Ft.

c. Mohs Hardness: >7

d. Roundness: >0.6

e. Sphericity: >0.6

f. Angle of Repose: 30 degrees

g. When placed in the synthetic turf, the system shall have an Abrasion Index of <26.

3. The synthetic grass field system shall be brushed prior to installation and after installation of the infill with an approved sweeping apparatus containing full length magnets to ensure no foreign metal material is present in the completed field.

4. Volume/weight: The in-fill system shall leave the specified length of fiber exposed after settlement.

5. Anti-static: The turf system shall be treated with an anti-static material before brushing. The anti-static material shall be applied at the rate of 0.10 gallon per square yard of undiluted material. Anti-static material shall be as manufactured by Bristol-Meyer, Lever Brothers, or approved equal.

F. Perforations

1. For porous synthetic grass, all carpet shall be perforated, or non-perforated porous backing, to provide vertical drainage as specified herein.

2. Size and spacing of perforations shall be as specified herein. Spacing of perforations shall be uniform in both directions.

3. Perforations shall be complete and full diameter for a minimum of 95% of the each roll.

4. Perforations shall be tested by passing a 3/8" drill bit through the holes with no more than 7 lbs. pressure.

G. Field Maintenance equipment

1. The General Contractor shall furnish to Owner all necessary tools and equipment to properly maintain the synthetic grass system.

a. Turf Groomer: The Contractor shall supply at the end of the Project one new and unused Synthetic Sports Synthetic Turf Groomer with patented brush design that will lift synthetic grass fibers leaving them in a plush, upright position while moving infill material to fill in low spots or depressions left after play. Brushes shall be Synthetic Super Duty Blue Brushes which retain their original shape, resist wear, and will not rot. Groomer shall be equipped with a GreensSlicer Spring Tine Rake consists of 3 rows of 28 tines spaced 7/8 inch apart for thorough coverage and a Spring Tine Rake Brush Attachment. Or approved equal.

b. Debris Sweeper: The Contractor shall supply at the end of the Project one new and unused 73” minimum width drag-behind rotary debris sweeper with integrated magnets for cleaning the field surface. This will be used for removing leaves, loose paper and other debris.

c. Maintenance Car: The Contractor shall supply at the end of the Project one new and unused John Deere Gator XUV 825E 4x4 with turf tires or approved equal.

1) 52 hp (812 cc) (minimum) gas engine. Electronic Fuel Injection (EFI)

2) 44 mph top speed (27 mph in low range)

3) Standard Occupant Protection System (OPS) with a passenger-side hand-hold and 3-point seat belts is SAE and OSHA ROPS-certified.

4) 1,000 lb. cargo box capacity, 1,500 lb. towing and 1,400 lb. payload capacity.

5) Two-range CVT transmission for superior low-speed pulling and towing ability

6) Front/Rear hydraulic disc with twin piston front calipers and driveline, internal wet multi-disc, hand operated parking brake.

7) Engineered plastic (JDLOY) can be painted and provides improved scratch and marring resistance/recoverability

8) Standard bumper.

9) Independent Rear Suspension (IRS)

10) Larger styled wheels and tires suitable for use on synthetic grass field.

d. Topsoil Rakes: The Contractor shall supply at the end of the Project two (2) new and unused 36 inch wide aluminum topsoil hand rakes.

e. Hand Brushes: The Contractor shall supply at the end of the Project two (2) new and unused 36 inch wide nylon bristles push brooms.

f. Hand Shovel: The Contractor shall supply at the end of the Project two (2) new and unused 27 inch aluminum scoop shovel with fiberglass handle.

g. Five (5) Gallon Bucket: The Contractor shall supply at the end of the Project two (2) new and unused five (5) gallon bucket with handle and lid.

h. Infill Depth Gauge: The Contractor shall supply at the end of the Project six (6) new and unused 3 inch (75 mm) infill depth gauges as manufactured by Hydra-Cone, Inc. 800-673-2437, hydraconejeff@comcast.net or approved equal.

H. Additional Field Materials (Attic Stock)

1. The Contractor shall supply and deliver an additional 100 lineal feet of full width (15') material, plus 5 linear feet of full width (15') of each color used.

2. The Contractor shall supply and deliver an additional 1,000 lbs of coated sand in-fill material as specified for the field. The coated sand infill shall be placed in RubberMaid 50 gallon containers with covers.

3. Seaming Tape and Adhesive: Provide 100' linear feet of seaming tape and sufficient gluing materials necessary for seaming repair. Materials shall be easily used by the Owner.

PART 3 EXECUTION

3.1 GENERAL

A. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any hazardous conditions and/or discrepancies.

B. Weather Permitted Conditions: The Contractor shall not perform any work if the conditions for working are:

1. Ambient air temperatures are below 45 degrees F.

2. Material temperature falls below 45 degrees F.

3. Rain is forecast or falling

4. Conditions exist or are pending that will be unsuitable to the installation of the system.

C. Drawings / Specifications: The Contractor shall perform all work in strict accordance to the Contract Drawings / Plans, Shop Drawings and manufacturer's specifications and instructions.

D. Verification: The Contractor shall be responsible for the inspecting, verifying and completing all installed work of this section.

3.2 EXAMINATION

A. Acceptance of Prior Work: Upon completion of the base and drainage work, the Site General Contractor shall submit a letter, addressed to the Owner, signed by the Site General Contractor and the Synthetic Grass Surfacing Installer. The letter shall confirm Synthetic Grass Surfacing base has been reviewed, including all testing data, and is acceptable for installation of the Synthetic Grass Surfacing. Any discrepancies, problems, and/or conflicts shall be addressed prior to issuance of the letter. Continuing with the installation of the Synthetic Grass Surfacing over the base without issuance of such letter shall be considered as an approval of the base by the Synthetic Grass Installer.

3.3 PREPARATION

A. The Contractor shall take special care to protect all field and stadium structures and utilities. Any damage shall be repaired or replaced at the cost of the Contractor.

B. Layout: The Contractor shall be responsible for furnishing, setting and marking all lines, seams and markings for the field. The Contractor shall at all times maintain all necessary benchmarks and control points to locate all events and markings.

C. Slope: The field shall be installed with a minimum 0.5% and maximum 0.75% slope unless otherwise noted in the Drawings, from the center crown to the sideline or track edge.

1. The finish profile of the crown of the field may not exceed grade shown on the Drawings. This will be maintained throughout the length of the crown. See Drawings for detail of the crown grading.

3.4 ERECTION

3.5 INSTALLATION

A. Synthetic Grass Surfacing Installation

1. The synthetic grass shall be staged and unrolled as necessary for a daily installation. No material will be allowed to be unrolled 24 hours prior to installation.

2. If a shock pad is required, the in-situ pad can be installed over the accepted base. Control of the finish grade and contour shall be the responsibility of the Contractor. The use of a pre-manufactured pad will be acceptable.

B. Seams

1. All panel seams shall be securely sewn and/or glued to a backing material of nylon or mylar.

2. All panel seams spacing are to be held to a minimum of 15 feet unless prior approval of seaming diagram indicates a lesser panel.

3. All inlaid areas shall have full fastenings and no loose areas. At no time can pulling on the section separate the material.

4. All seams and inlaid areas shall be brushed thoroughly before infill materials are installed.

C. Synthetic Grass System Edges and Termination

1. All edges and ends of the synthetic grass system shall be secured to the termination nailer. This termination shall be as detailed in the Drawings and as specified in 03 3200 Site Cast In Place Concrete.

D. Lines, Markings, Logos, and In-Lays

1. All markings and lines shall be in-laid using the synthetic grass of the accepted colors.

2. All lines, numbers, and field markings are to be tufted or inlaid (shaving is not permitted) with the specific colored synthetic grass.. All lines and markings shall be accurately set and surveyed to within 1/2” tolerance.

3. All lines and markings shall be installed and verified prior to any installation of in-fill material.

E. Synthetic Grass Surfacing Infill

1. No in-fill materials shall be installed until the synthetic grass surfacing is fully installed with all lines and markings.

2. The synthetic grass surfacing shall be thoroughly brushed prior to any in-fill materials to remove any wrinkles and defibrillate the slit film.

3. The in-fill shall leave specified depth of exposed fiber after settlement.

4. The in-fill materials shall be installed in layers not to exceed 0.30 lbs per sq ft per layer.

3.6 PROTECTION

A. The Contractor shall take special care to protect all field and stadium structures and utilities. Any damage shall be repair or replaced at the cost of the Contractor.

3.7 TRAINING

A. Training Instruction and Owners Manuals

1. Provide a 4 hour, at a minimum, on-site training instructional program for the Owner. The training shall include review and demonstration generally of the following, but not be limited to:

a. Daily/Weekly fiber, infill, and seam inspections.

b. Low infill hand grooming and infill placement.

c. Seam repair.

d. Field sweeping, grooming, and decompaction (with tines groomer if applicable). Including demonstration of hook-up, detachment, and use of all equipment with the Owner's equipment.

e. Field plowing (if applicable).

f. Protection for events.

g. Procedure for Warranty claims.

2. The training instruction will be summarized on a DVD included in the Owner's Manual and close-out documents.

3. Training shall take place no later than 5 days after article "Testing, Post-Construction" is completed.

3.8 AS BUILT FIELD LAYOUT DRAWING

A. Provide As Built Field Layout Drawing including verification of field layout dimensions to the Engineer.

3.9 CLEAN UP

A. The site shall be kept clean and free of debris throughout the installation. Empty barrels, sacks, bags, and remnant materials shall be stored or disposed daily in a proper container or legal manner.

B. After completion of the entire Project, the site shall have a general cleanup removing all debris remaining on the site that is not a part of the final Project.

C. The equipment supply requirements for this Project shall be part of the total price and shall be the sole expense of the Contractor.

D. All natural grass areas disturbed during this construction shall be restored to the satisfaction of the Owner at no additional cost to the Owner.

E. All attic stock materials shall be placed in it's appropriate location as determined by the Owner.

3.10 ACCEPTANCE

A. Should any imperfections develop in the surface areas prior to the final acceptance of the work, they shall be removed and replaced with new materials. All such repair work shall be done at no additional cost to the Owner.

B. Acceptance will be issued to the Contractor as described under “Substantial Completion” when all work under this section is found to be completed. The Owner or Engineer will not be responsible for any additional acceptance requirements by the Contractor or subcontractor.

END OF SECTION

SECTION 32 18 23-31

ALL-WEATHER RUNNING TRACK SURFACING - POLYURETHANE STRUCTURAL SPRAY

PART 1 GENERAL

1.1 SUMMARY

A. The work under this section includes the installation of a cast in place, durable, permeable, resilient, all-weather track surface consisting of a polyurethane bound rubber base mat and structural spray top coat.

B. Work of this specification consists of furnishing all the required labor, materials, equipment, parts and supplies necessary for this installation of the synthetic running track surface.

C. The manufacturer of all installed materials shall be the same as the installer.

D. The work hereunder shall be done and conform to:

1. American Sports Builders Association Track Construction Manual and Track Construction Guidelines

1.2 REFERENCES

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

B. National Asphalt Pavement Association (NAPA)

C. USA Track & Field (USATF)

D. National Federation of State High School Associations (NFHS)

E. National Interscholastic Athletic Administrators Association (NIAAA)

F. International Association of Athletics Federation (IAAF)

G. American Sports Builders Association (ASBA)

1.3 JOB CONDITIONS

A. Weather Limitations

1. The urethane mixture shall not be placed whenever the surface is wet, frozen, or when the temperature is outside the limitations stated by the manufacturer’s recommendations for installation. Contractor shall be responsible for submitting the procedure at least one week in advance of any surfacing operations that may result in placement of the all-weather running track urethane surfacing outside of the temperature limitations.

1.4 BID-SUBMITTALS

A. Only one each of the following bid submittals are required to the bidding entities at the time of bid:

1. A letter on the Contractor / Sub-contractor's letterhead (whomever shall be supplying and installing the all-weather track surfacing system) shall be submitted, with the bid, confirming their intent to conform to all information presented during the bidding process for the All-Weather Track Surfacing System. Including, but not limited to, the bid Drawings, Specifications, Addendum, and RFI Clarifications.

2. Non-compliance with the bid submittal requirements as specified herein will result in rejection of the bid.

1.5 SUBMITTALS

A. Manufacturer's product data sheets including installation guidelines for components and system.

B. Manufacturer's color options for review and selection by the Engineer/Owner.

C. Three (3) representative samples of the system to be installed with appropriate labeling for identification and color as selected by Engineer/ Owner.

D. Current material safety data sheets (MSDS) for the liquid components.

E. Test reports that verify the manufacturer's specifications (data) for the product to be installed.

F. Documentation that verifies that the synthetic surfacing material does not contain any toxic or hazardous substance, which exceeds limits set forth by the EPA.

G. The synthetic surfacing material manufacturer shall submit a letter stating that the surfacing contractor is qualified to install its synthetic surface system.

H. A certificate from the manufacturer of the binders and coatings stating that the materials have been produced specifically for the use in sports surfacing construction.

I. A complete list of materials intended to be used in the construction of the running track system. All liquid quantities will be prior to dilution.

J. Provide a letter stating that the surfacing contractor has reviewed the asphalt specification and accepts the specification as correct.

K. Provide a letter after checking the asphalt accepting it for synthetic surface installation. Should areas be found that do not meet specifications, they shall be repaired or replaced by the asphalt contractor prior to the synthetic surfacing contractor issuing its letter of acceptance.

L. A test report that the ½" (13 mm) system has been tested to IAAF standards for force reduction and modified vertical deformation. Force reduction shall be 35-50%. Modified vertical deformation shall be 0.6-1.8 mm.

M. Submit evidence that the synthetic surfacing contractor holds the necessary contractor's license to install synthetic surfacing.

N. Submit evidence that the material manufacturer is ISO 9001 certified.

O. Contractor to shall provide written maintenance information on the installed product to be presented to the owner upon completion of the surface. This shall include repair methods and availability of repair materials including cost. Submit 3 copies of the approved Surfacing Care and Maintenance Guide.

1.6 COORDINATION

A. Contractor shall coordinate with all other trades, especially Site Contractors to ensure approval of asphalt base prior to surfacing application. Any rework shall be done at no cost to the Owner.

1.7 RELATED WORK

A. When surfacing on new bituminous pavement, the bituminous pavement must meet the specifications and standards set forth by the Engineer. The contractor shall be responsible of performing an elevation survey of the bituminous pavement prior to application of the synthetic track surface. The contractor is to perform a flood test of the bituminous pavement top course prior to application of the synthetic track surface.

B. The bituminous pavement shall be sufficiently cured and cleaned prior to Work of this section to be performed. The governing guidelines of track construction allow for a maximum longitudinal slope of one tenth of one percent (0.10%) in the running direction. The maximum lateral slope shall not exceed one (1) percent (1.00%)

C. Grade conformance tests may be required to be performed by the Contractor on both the leveling course and the top course of the bituminous pavement at the Engineer´ s discretion. The entire surface shall provide positive drainage to the inside edge of the track. The maximum allowable planarity deviation within a pass should be 1/4 inch in 10 feet when measured in any direction. Deficient areas in the leveling course should be corrected as approved by the Engineer. After any corrections, the surface shall not allow water to stand greater than 1/16 inch deep, one (1) hour after rain has ended.

D. The Contractor shall be responsible to have adjacent grass edged and removed from all areas receiving the synthetic surface. It may be necessary to apply a liquid herbicide such as Roundup to any adjacent edges of track and event areas.

1.8 MATERIAL HANDLING AND STORAGE

A. Materials should be delivered in manufacturer’s container to maintain clean and dry conditions. See manufacturer’s guidelines for temperature requirements for the locale of installation.

B. Store material in accordance with manufacturer’s specifications and MSDS.

C. The contractor shall provide a secure, clean, dry location for storage of materials at temperature as above. Under no circumstances should materials be stored outside unless fully protected from moisture with 10 mil polyethylene barrier and tarpaulin. All materials stored outside shall be inspected by dealer for moisture contamination before application.

D. Deliver products to the site in original, unopened containers with labels attached.

E. All surfacing materials shall be non-flammable.

1.9 QUALITY ASSURANCE

A. Provide a certificate of accuracy from a registered engineer, land surveyor or certified track builder by ASBA that the track measures 400 meters in all lanes from start to finish.

B. The contractor shall record the batch number of each product used on the site and maintain it throughout the warranty period.

C. The contractor shall provide the Engineer, an estimate of the volume of each liquid product and the weight of the rubber granule to be used on site.

D. The manufacturer's representative will be available to help resolve material issues.

E. Provide, as a part of the Warranty, documents stating that the materials applied conform to the manufacturer's specifications and that the material will not separate from the asphalt or concrete base, blister, bubble, fade, crack or wear excessively during the life of the warranty.

F. The materials will not foam, thus causing air bubbles and reduce the life expectancy of the surface.

G. The synthetic surfacing contractor and owner will annually walk and inspect the synthetic surface during the life of the warranty. Issues will be documented in writing to the Owner. The Owner will review items with the Engineer. Warranty issues will be repaired and for non-warranty items a method for correction will be presented.

H. Track system shall subject to successfully tested independently an accredited IAAF testing house to the requirements of the IAAF Performance Specifications for Synthetic Surface Athletics Tracks (Outdoor) dated January 1990.

I. The synthetic surfacing contractor shall maintain a clean and orderly job site. All excess materials shall be removed from the construction area and properly disposed of. Scrap shall be removed in the same manner.

1.10 GUARANTEE

A. The Contractor shall be required to guarantee all labor, materials, workmanship and services for the Synthetic Surface and Track Markings.

B. This guarantee shall remain in force for a period of not less than FIVE (5) YEARS from the date of written acceptance of the work.

C. Any defects caused by delaminating, peeling, normal abrasion or raveling that is not in original conformance with the testing specifications shall be repaired or replaced at no cost to the Owner during this guarantee period.

D. This Contractor shall be required to submit the following documents in regard to the guarantee:

1. Letter from the manufacturer(s) of all materials attesting to the guarantee length and limits. This must be signed by an officer of the organization.

2. Maintenance Instruction Guide for the Contract Surfaces, signed by an officer of the surface company and notarized.

3. Letter of Guarantee from the Installation Contractor for the above time period, signed by an officer of the Company and notarized.

4. These documents shall be submitted to the Owner prior to final payment. The installer and the materials manufacturer shall supply a warranty covering labor and materials respectively. The warranty period shall be for five (5) years.

1.11 INSTALLER QUALIFICATIONS

A. Installers shall be regularly engaged in the construction and surfacing of running tracks.

B. Installer shall be an authorized applicator of the specified system.

1. Installers of this product are to provide a list of at least 10 installations that are a minimum of 5 years old that contain the same products, and use the same method of installation. Include:

a. Project Name

b. Address

c. Owners Representatives Name

d. Owners Representatives Email

e. Owners Representatives Phone

2. Completed projects are to have been installed under the same company name and ownership that is presently bidding.

C. Installer shall be a builder member of the ASBA.

D. The installer′ s installing foreman must have at least 8 years experience installing the specified type of synthetic track surface system.

1.12 MANUFACTURER QUALIFICATION

A. System manufacturer shall certify that the materials provided are manufactured specifically for construction and surfacing of running tracks.

B. System manufacturer shall be continuously engaged in the business of track surfacing materials for at least 10 years.

C. System manufacturer of this product are to provide a list of at least 20 installations that are minimum of 3 years old that contain the same products, and use the same method of installation.

1. Include:

a. Project Name

b. Address

c. Owners Representatives Name

d. Owners Representatives Email

e. Owners Representatives Phone

2. Completed projects are to have been installed under the same company name and ownership that is presently bidding.

D. System manufacturer shall have a designated representative available for site inspection.

PART 2 PRODUCTS

2.1 GENERAL

A. The synthetic surfacing shall be a 13 mm (1/2") thick, permeable, structural spray system, with a paved in place rubber granule and polyurethane binder base layer. Two coats of a mixture of colored polyurethane and EPDM rubber granules are structurally sprayed onto the base to form a textured finish.

B. The synthetic track surface system shall have a smooth finish and may be applied for both indoor and outdoor use.

C. The structural spray applied polyurethane and rubber blended coating shall be resilient and allow moisture to pass through the surface. It shall have a textured finish for outdoor applications.

D. The product shall meet the following minimum physical properties:

1. Top Color: Red (Final color to be approved by Engineer based on manufactures standard colors)

E. Performance Standards

	Test Results	DIN Standard
Thickness (DIN):		min. 13 mm
Force Reduction (IAAF):		35-50%
Modified Vertical Deformation (IAAF:		0.6 mm – 2.5 mm
Permeability:		min 0.01 cm/s
Friction (wet) (IAAF):		> 0.5
Friction (dry) (DIN):		<1.1
Tensile Strength (IAAF):		≥ 0.4 MPa
Elongation (IAAF):		>40%
Spike Resistance (DIN)		Class 1

F. Product substitution: If other than the product specified, the contractor shall submit at least 7 days prior to the bid date a complete type written list of proposed substitutions with sufficient data, drawings, samples and literature to demonstrate that the proposed substitution is of equal quality and utility to that originally specified. Information must include a QUV test of at least 1,000 hours and IAAF test information for the system to be installed

G. Any materials used must be an emulsion/water based product. Any products which require solvents such as MEK, Butyl Cellusolve or Acetone for clean up or mixing are not acceptable.

H. Materials must have a VOC less than 150g/lt. for binder products. Top coats shall have a VOC of less than 100g/lt. measured by EPA method 24.

I. Materials may not have a flash point of less than 200°F.

J. All Materials shall have documented independent test results by an accredited IAAF testing house to the requirements of the IAAF Performance Specifications for Synthetic Surface Athletics Tracks (Outdoor) dated January 1990.

2.2 MATERIALS

A. Rubber – Polyurethane Track Basemat (SBR)

1. The polyurethane track base mat rubber shall be specifically graded rubber granules with a controlled gradation between 1.0mm to 3.00mm.

a. Dust and rubber particulate smaller than a No. 200 sieve size shall not exceed 1 percent of the total rubber.

b. The rubber shall be black SBR

B. Rubber – Structural Spray Top Coat (EPDM)

1. EPDM colored virgin rubber granules that are processed and graded to 0.5 – 1.5 mm in size unless otherwise specified. The rubber shall contain a minimum of 20% EPDM and be approved by the resin manufacturer. The specific density shall be 1.60 +/- 0.08 and Shore A hardness of 60.

C. Primer

1. The synthetic track surface primer shall be polyurethane based and compatible with asphalt and synthetic track surfacing materials.

2. When installing over a concrete pavement special developed concrete primer, manufactured by the same manufacturer of the other materials, shall be applied.

D. Binder

1. The synthetic track surface binding agent shall be a single component; MDI based moisture cure polyurethane binder. The binder shall not have a free TDI monomer level above 0.2% and must be solvent free.

a. The polyurethane binder shall be 100 percent solids.

b. The polyurethane binder shall be compatible with SBR and EPDM rubber granules.

2. All polyurethane binder shall be manufactured by the installation company and to be delivered in new unopened containers, clearly labeled by the manufacturer.

E. Structural Spray Coating

1. The spray coating shall be a MDI-based single-component, moisture cured, 100% solids, and pigmented polyurethane, specifically formulated for compatibility with EPDM granules.

a. The coating shall be the color specified by the Engineer.

b. Pigment intergraded in the field shall not be allowed.

F. Aliphatic Spray Coat

1. Shall be a two component varnish with high quality UV resistance.

PART 3 EXECUTION

3.1 GENERAL

A. The bituminous pavement should be sufficiently cured and cleaned in order for work to progress

B. The entire surface shall be swept, power blown, or high pressure washed to remove all dirt, oil, grease, or any other foreign matter. The surface shall be free from any loose material.

C. All work shall be performed by manufacturer's technicians and comply with the manufacturer's guidelines for the complete placement and installation of the base layer, the sealing and surface layers.

D. During surface installation and striping all sprinkler systems shall be shut off, or controlled so that no water falls on the track or event surfaces.

E. All materials shall be installed in strict compliance with the manufacturer´ s specifications and instructions.

F. The Contractor shall be responsible to have the entire track area, and other pertinent areas such as football field, concessions, etc., closed and secured of all activities 24 hours per day through the curing and completion of the synthetic track surface.

3.2 WEATHER LIMITATIONS

A. Ambient and surface temperatures must be 50°F and rising.

B. Installation should not be conducted during rainfall or when rainfall is imminent.

C. Do not apply when surface temperature is in excess of 140°F.

D. Apply the synthetic surfacing material only during favorable weather conditions. Work is to proceed only when adequate curing can be guaranteed by the manufacturer and installer.

3.3 SURFACE PREPARATION

A. New asphalt shall be allowed to cure for a minimum of 28 days prior to the application of any surfacing materials.

B. All concrete work is to cure for a minimum of 45 days. No curing agents are to be used. Any concrete flat work such as run ups etc. will be checked as in 3.3D.

C. The surface must be thoroughly cleaned of all loose dirt and debris. Any oil spills (hydraulic, diesel, motor oil, etc.) must be completely removed, either by chipping out or removing and replacing with new, keyed in asphalt.

D. Prior to the application of resilient surface materials, the entire asphalt base surface shall be checked for planarity, surface tolerance, and flooded and checked for depressions or irregularities in the asphalt. Any puddle area covering a nickel shall or vary +/- ¼ inch when measured with a 10-foot straightedge in any direction shall be marked and repaired with Patch Binder, according to manufacturer's specifications and approved by the Engineer. After patching, the asphalt surface shall not vary allow water to stand greater than 1/16 inch, one (1) hour after a flood test has been pre-formed. Slopes shall meet the guidelines of the ASBA and NFHS.

E. It should be the responsibility of the contractor to flood the surface.

1. If, after 40 minutes of drying time, there are birdbaths evident, it shall be the responsibility of the landscape architect, in conjunction with the surfacing contractor, to determine the method of correction. No cold tar patching, skin patching or sand mix patching will be acceptable.

2. Any oil spills (hydraulic, diesel, motor oil, etc.) must be completely removed and replaced with either polyurethane or new, keyed in asphalt. The minimum curing time for the asphalt base repair is 28 days. It shall be the responsibility of the surfacing contractor to determine if the asphalt substrate has cured sufficiently prior to the application of the polyurethane surfacing system.

3. It shall be the responsibility of the general contractor to determine if the asphalt substrate meets all design specifications, i.e. cross slopes, planarity and specific project criteria. After all the above conditions are met, the synthetic surfacing contractor must, in writing, accept the planarity of the asphalt receiving base, before work can commence.

3.4 RESILIENT SURFACE INSTALLATION

A. Primer

1. The entire area to be surfaced shall receive an application of polyurethane primer applied uniformly at a rate between 0.20-0.30 lb. per sq. yd. A minimum cure time of 30 minutes is required before application of the base mat materials.

2. Only the area to be covered within the working day should be primed to ensure a good bond to the base. Concrete base may require additional coating based on absorption rate of applied primer.

B. Polyurethane Track Basemat

1. The mixing ratio of rubber to binder shall not be less than100 parts rubber to 20 part binder as determined by the weight of the products. The materials shall be prepared in a mechanical mixer until a homogenous mix is obtained.

2. The mixed materials making up the synthetic track surface shall be applied by a mechanically operated finishing machine, which shall have an electrically heated screed, to an approximate depth of 11 - 12 mm using approximately 17.33 lbs/sy of mixed material.

3. The cured edge of each joint shall be primed with the synthetic track surface binding agent prior to the laying of the adjacent base mat. All joint work shall be troweled flush with the adjacent mat.

4. Trowel work: All seams shall be troweled smooth within the pot life of the material. All edges shall be straight and rounded by turning the trowel. All cold dry seams shall be cut straight at an inward angle and primed prior to commencing with subsequent work.

C. Structural Spray Top Coat (two applications)

1. The polyurethane track base mat shall be cleaned and prepared prior to the installation of the structural spray top coat in accordance with the manufacturer` s specifications and instructions.

2. According to the manufacturer´ s specifications, the specified quantity of colored EPDM granules shall be mixed thoroughly with the specified quantity of the one component polyurethane of the structural spray material.

3. Structural Spray Coat (two applications) – is spray applied with air and volume controlled spray equipment. Care is to be taken so as to provide an even surface without streaking..

4. A second coat of material over the first is applied in the opposite direction. The total rate of each coat of spray shall range from 3.5 to 4.0 lbs. per square yard.

3.5 MARKING AND MEASUREMENTS

A. Wait 48 hours after surface completion before applying line marking.

B. Experienced personal specializing in all-weather running track striping shall accomplish all striping.

C. See Track Markings Section

3.6 PROTECTION

A. During construction, the installer is responsible for limiting access of non-construction personnel to the site.

B. The installation contractor shall coordinate any irrigation of fields with the owner.

C. The installer shall protect curbs, fences and other structures from overspray.

3.7 QUALITY ASSURANCE

A. Track system shall subject to successfully tested independently an accredited IAAF testing house to the requirements of the IAAF Performance Specifications for Synthetic Surface Athletics Tracks (Outdoor) dated January 1990

3.8 CLEAN UP

A. Remove all containers, surplus and debris and dispose of in accordance with local, state and Federal regulation.

B. Remove all spills and overruns.

C. Leave site in a clean and orderly condition on a daily basis.

D. Upon completion of all work, remove all containers, surplus materials, and installation debris. Leave area of work in clean orderly condition.

END OF SECTION

SECTION 32 1823.35

ALL-WEATHER RUNNING TRACK SURFACING - MARKINGS

PART 1 GENERAL

1.1 SUMMARY

A. Work of this specification consists of furnishing all the required labor, materials, equipment, parts and supplies necessary for this installation of the synthetic running track striping and markings.

B. The work hereunder shall be done and conform to:

1. American Sports Builders Association Track Construction Manual and Track Construction Guidelines

2. Connecticut Interscholastic Athletic Conference (CIAC) and the National Federation of State High School Associations (NFHS) for track and field event layout.

1.2 REFERENCES

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

B. National Asphalt Pavement Association (NAPA)

C. USA Track & Field (USATF)

D. National Federation of State High School Associations (NFHS)

E. National Interscholastic Athletic Administrators Association (NIAAA)

F. International Association of Athletics Federation (IAAF)

G. American Sports Builders Association (ASBA)

1.3 JOB CONDITIONS

A. Weather Limitations

1. The striping mixture shall not be placed whenever the surface is wet, frozen or when the temperature is outside the limitations stated by the manufacturer’s recommendations for installation. Contractor shall be responsible for submitting the procedure at least one week in advance of any surfacing operations that may result in placement of the all-weather running track striping material outside of the temperature limitations.

1.4 SUBMITTALS

A. Manufacturer’s specifications for components and system.

B. Current material safety data sheets (MSDS) for the liquid components.

C. Current Authorized Applicator certificate from the surface system manufacturer.

D. A certificate from the manufacturer of the striping material stating that the materials have been produced specifically for the use in all-weather track surfacing striping.

E. A complete list of materials intended to be used in the striping of the running track system. All liquid quantities will be prior to dilution.

F. Contractor to shall provide written maintenance information on the installed product to be presented to the owner upon completion of the surface. This shall include repair methods and availability of repair materials including cost. Submit 3 copies of recommended Surfacing Care and Maintenance Guide.

G. Upon completion, supply the Owner with all necessary as-built drawings showing markings color coding of each event.

H. Upon completion, a letter of certification attesting to the accuracy of the markings shall be submitted by the Professional Engineer or Land Surveyor in charge of the layout. The letter shall be signed and sealed by the person or persons in charge of the layout indicating the state of registration, number and name.

1.5 COORDINATION

A. Contractor shall coordinate with all other trades, especially all-weather track surfacing installer to ensure approval of track surfacing prior to striping application. Any rework shall be done at no cost to the Owner.

1.6 RELATED WORK

A. The all-weather track surfacing shall be sufficiently cured and cleaned prior to work of this section to be performed.

1.7 MATERIAL HANDLING AND STORAGE

A. Materials should be delivered in manufacturer's container to maintain clean and dry conditions. See manufacturer's guidelines for temperature requirements for the locale of installation.

B. Store material in accordance with manufacturer's specifications and MSDS.

C. The owner shall provide a secure, clean, dry location for storage of materials at temperature as above. Under no circumstances should materials be stored outside unless fully protected from moisture with 10 mil polyethylene barrier and tarpaulin. All materials stored outside shall be inspected by dealer for moisture contamination before application.

D. Deliver products to the site in original, unopened containers with labels attached.

E. All surfacing materials shall be non-flammable.

1.8 QUALITY ASSURANCE

A. Track system shall be subject to testing by an independent accredited IAAF testing house. The track system must adhere to the requirements of the IAAF Performance Specifications for Synthetic Surface Athletics Tracks (Outdoor) dated January 1990.

1.9 GUARANTEE

A. See the warranty section

B. The installer and the materials manufacturer shall supply a warranty covering labor and materials respectively. The warranty period shall be for five (5) years.

1.10 INSTALLER QUALIFICATIONS

A. Installers shall be regularly engaged in the striping of running tracks.

B. Installer shall be an authorized applicator of the specified system.

1. Installers of this product are to provide a list of at least 10 installations that are a minimum of 5 years old that contain the same products, and use the same method of installation. Include:

a. Project Name

b. Address

c. Owners Representatives Name

d. Owners Representatives Email

e. Owners Representatives Phone

2. Completed projects are to have been installed under the same company name and ownership that is presently bidding.

C. Installer shall be a builder member of the ASBA.

D. The installer´ s installing foreman must have at least 8 years experience installing the specified type of synthetic track surface system.

1.11 MANUFACTURER QUALIFICATION

A. System manufacturer shall certify that the materials provided are manufactured specifically for construction and surfacing of running tracks.

B. System manufacturer shall be a US owned company that has been continuously engaged in the business of track surfacing materials for at least 10 years.

C. System manufacturer of this product are to provide a list of at least 20 installations that are minimum of 3 years old that contain the same products, and use the same method of installation.

1. Include:

a. Project Name

b. Address

c. Owners Representatives Name

d. Owners Representatives Email

e. Owners Representatives Phone

2. Completed projects are to have been installed under the same company name and ownership that is presently bidding.

D. Striping paint manufacturer shall have a designated representative available for site inspection.

PART 2 PRODUCTS

2.1 GENERAL

A. Paint shall be that material as recommended by the manufacturer of the track surface.

B. All markings shall receive two (2) coats of paint to achieve the full opaque results.

2.2 MATERIALS

A. Paint shall be polyurethane based for all system except for rubberized asphalt and the latex systems.

B. No thinners shall be used.

C. No painting shall be performed when the velocity of the wind exceeds twelve (12) MPH, unless the spray equipment is equipped with the proper air curtains.

PART 3 EXECUTION

3.1 GENERAL

A. Ambient and surface temperatures must be as recommended by the manufacturer, but not less than 50°F and rising.

B. Installation should not be conducted during rainfall or when rainfall is imminent.

C. Do not apply when surface temperature is in excess of 140°F.

D. The all-weather track surfacing should be sufficiently cured and cleaned in order for work to progress.

E. The entire surface shall be swept, power blown, or high pressure washed to remove all dirt, oil, grease, or any other foreign matter. The surface shall be free from any loose material.

F. All work shall be performed by manufacturer's technicians and comply with the manufacturer's guidelines for the complete placement and installation of the base layer, the sealing and surface layers.

3.2 WEATHER LIMITATIONS

A. Ambient and surface temperatures must be 50°F and rising.

B. Installation should not be conducted during rainfall or when rainfall is imminent.

C. Do not apply when surface temperature is in excess of 140°F.

D. Apply the synthetic surfacing material only during favorable weather conditions. Work is to proceed only when adequate curing can be guaranteed by the manufacturer and installer.

E. During surface installation and striping all sprinkler systems shall be shut off, or controlled so that no water falls on the track or event surfaces.

F. All materials shall be installed in strict compliance with the manufacturer´ s specifications and instructions.

G. The Contractor shall be responsible to have the entire track area, and other pertinent areas such as football field, concessions, etc., closed and secured of all activities 24 hours per day through the curing and completion of the synthetic track surface.

3.3 SURFACE PREPARATION

A. New asphalt shall be allowed to cure for a minimum of 14 days prior to the application of any surfacing materials.

B. The surface must be thoroughly cleaned of all loose dirt and debris.

C. Prior to the application of resilient surface materials, the entire asphalt base surface shall be checked for planarity, surface tolerance, and flooded and checked for depressions or irregularities in the asphalt. Any puddle area covering a nickel shall or vary +/- ¼ inch when measured with a 10-foot straightedge in any direction shall be marked and repaired with Patch Binder, according to manufacturer's specifications and approved by the Landscape Architect. After patching, the asphalt surface shall not vary allow water to stand greater than 1/16 inch, one (1) hour after a flood test has been preformed. Slopes shall meet the guidelines of the ASBA and NFHS.

3.4 ALL-WEATHER TRACK MARKINGS

A. Markings

1. Shall be marked for 8 - 42" lanes and include all event markings as recommended by NFSHSA requirements. Also included shall be those additional events as indicated in the specifications.

2. Logo

B. Computations

1. Verify the locations of purposed events with the Owner.

2. Calculations shall be made to the nearest 1/10,000th of a foot.

3. Calculations of the angle shall be made to the nearest one second.

4. Calculations shall be submitted to the Landscape Architect prior to the painting.

5. Calculations shall be made by or certified by the engineer or surveyor completing the work.

C. Layout

1. Lines and markings shall be made by a competent, experienced and fully qualified Track Marking Professional.
2. Locate and confirm both new radius points.
3. Establish and set all necessary control points.
4. Measurements shall be made on the track to the nearest 1/100th of a foot.
5. Angles shall be set by using a transit or theodilite capable of reading direct to 20 seconds.
6. The markings on the curve may also be set by using the chord length method.
7. Measurements shall be made with an engineering steel tape in engineering scale.
8. All markings shall be clearly identified and color coded for the painter to identify.

D. Symbols

1. All lanes and lines shall be white 2" wide markings
2. All starts and finishes shall be 2" wide lines
3. Starting Lines:
   a. 100 Meters (on all straights) White
   b. 110 HH (on all straights) White
   c. 200 Meters White
   d. 300 Meters White
   e. 400 Meters White
   f. 800 Meters Green
   g. 1600/3200 Meters White
   h. 4x200 Meter Relay Red
   i. 4x400 Meter Relay Blue
4. Finish Line White
5. Break Line Green
6. Relay Exchange Zones:
   a. 400 Meters Yellow
   b. 800 Meters (Lane 1 only split color – Red/Yellow) Red

      1-2 and 2-3 Red: 3-4 Yellow (same mark as 400 meter, 2-3)

   c. 1600 Meters Blue

d. 3200 Meters Green

7. Hurdle Locations

   a. 100 Meter HH (girls) Yellow

   b. 110 Meter HH (boys) Blue

   c. 300 Meter LH/IH (girls/boys) Red

   d. 400 Meter HH (girls/boys) if required

   e. One-turn Stagger White

   f. Three-turn Stagger Blue

   g. Four-turn Stagger Red

8. Acceleration marks shall be a 9" wide by 9" long triangles marked clearly in the center of the lane.

9. Hurdle marks shall be 1" X 6" tic marks on the lane line on both sides of the lane.

10. Lane numbers shall be not less than 22" high and 38” wide and located as directed by the Owner in five (5) locations. Numbers shall be in two (2) colors (as selected by the Landscape Architect from the manufactures standard color line). All stencil bracing shall be filled in to achieve a solid graphic. Numbers shall be offset from starting lines and triangles to allow adequate room for starting blocks or transition areas for athletes.

11. Triangles shall be not less than 40’’wide x 12’’ high.

12. Event Identification shall be 4" letters stenciled below and to the right of lane no. 2 and mark.

13. Scratch lines for the jumping events shall be 12" wide. Include markings for both men’s and women’s distances under NFHS regulations.

14. All starts and finishes shall be clearly marked with the start of the said events.

15. One (1) mile mark.

16. All symbols shall have the proper color code for the event.

3.5 PROTECTION

A. During construction, the installer is responsible for limiting access of non-construction personnel to the site.

B. The installation contractor shall coordinate any irrigation of fields with the owner.

C. The installer shall protect curbs, fences and other structures from overspray.

3.6 QUALITY ASSURANCE

A. Upon completion, a letter of certification attesting to the accuracy of the markings shall be submitted by the Professional Engineer or Land Surveyor in charge of the layout. The letter shall be signed and sealed by the person or persons in charge of the layout indicating the state of registration, number and name.

B. All measurements and tolerances shall conform to those recommended by the Connecticut Interscholastic Athletic Conference (CIAC) and the National Federation of State High School Associations (NFHS) for track and field event layout.

3.7 CLEAN UP

A. Remove all containers, surplus and debris and dispose of in accordance with local, state and Federal regulation.

B. Remove all spills and overruns.

C. Leave site in a clean and orderly condition on a daily basis.

D. Upon completion of all work, remove all containers, surplus materials, and installation debris. Leave area of work in clean orderly condition.

END OF SECTION

SECTION 32 3113

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Furnishing and installing woven wire fencing systems of the type and height specified and supported by metal posts erected where indicated on the Drawings and as specified herein, including fence and gates.

B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. ASTM International (ASTM).

1. ASTM A90 – Standard Test Method for Weight (Mass) of Coating on Iron or Steel Articles with Zinc or Zinc Alloy.

2. ASTM A123 – Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

4. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.

5. ASTM A392 – Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.

6. ASTM A428 – Standard Test Method for Weight (Mass) of Coating on Aluminum-Coated Iron or Steel Articles.

7. ASTM A491 – Standard Specification for Aluminum Coated Steel Chain Link Fence Fabric.

8. ASTM A780 – Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

9. ASTM A817 – Standard Specification for Metallic-Coated Steel Wire for Chain Link Fence Fabric and Marcelled Tension Wire.

10. ASTM A824 – Standard Specification Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence.

11. ASTM B211 – Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire.

12. ASTM C94 – Standard Specification for Ready-Mixed Concrete.

13. ASTM F552 – Standard Terminology Relating to Chain Link Fencing.

14. ASTM F567 – Standard Practice for Installation of Chain Link Fence.

15. ASTM F626 – Standard Specification for Fence Fittings.

16. ASTM F668 – Specification for Polymer Coated Chain Link Fence Fabric.

17. ASTM F900 – Standard Specification for Industrial and Commercial Swing Gates.

18. ASTM F934 – Specification for Standard Colors for Polymer-Coated Chain Link.

19. ASTM F1043 – Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.

20. ASTM F1083 – Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

21. ASTM F1183 – Standard Specification for Aluminum Alloy Chain Link Fence Fabric.

22. ASTM F1664 – Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence.

D. Chain Link Fence Manufacturer's Institute

1. Chain Link Fence Manufacturer's Institute Product Manual, latest revision.

1.3 SYSTEM DESCRIPTION

A. Temporary Construction Fence:

1. Fence Height: 6 feet.

2. Mesh Size: 2 inches.

3. Mesh Gage: 12

4. Gates: Height of gates shall match that of fence. Width of gates shall be as shown on the Drawings.

5. Anchored post or driven posts where indicated. No top or bottom rails required.

6. Panelized/modular units where indicated. Two stabilizers per panel.

B. Chain Link Fence:

1. Fence Height: Varies, refer to the Drawings.

2. Mesh Size: 2 inches.

3. Mesh Gage: 9, measured prior to application of any coating.

4. Gates: Height of gates shall match that of fence. Type and size of gates shall be as shown on the Drawings.

5. Top, intermediate and bottom rails between posts unless otherwise indicated.

1.4 SUBMITTALS

A. Shop drawings showing the plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates and a schedule of components.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.

1. Fence and gate posts, rails, and fittings.

2. Chain-link fabric, fabric coatings, reinforcements, and attachments.

3. Accessories: Privacy slats.

4. Gates, locking mechanisms and hardware.

5. Gate operators, including operating instructions.

6. Motors (if applicable): Show nameplate data, ratings, characteristics, and mounting arrangements.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.

1. Gate Operator (if applicable): Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.

2. Wiring Diagrams (if applicable): For power, signal, and control wiring.

D. Samples for Initial Selection: For components with factory-applied color finishes.

E. Samples for Verification: Prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

F. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified factory-authorized service representative.

B. Product Certificates: For each type of chain-link fence system and gate, from manufacturer.

C. Product Test Reports: For framing strength, ASTM F1043.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:

1. Polymer finishes.

2. Gate hardware.

3. Gate operator.

1.7 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 this Section.

B. Supply material in accordance with Chain Link Fence Manufacturer's Institute Product Manual and this Specification.

C. Perform installation in accordance with ASTM F567.

D. Maintain all facilities installed under this Section in proper and safe condition throughout the progress of the work.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to existing improvements and/or proposed construction. Verify dimensions by field measurements. Notify Engineer of any dimensional discrepancies prior to proceeding with the work. Coordinate with Engineer regarding any adjustment or modification.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

B. Packages shall be labeled with the manufacturer's name.

C. Store fence fabric and accessories in a secure and dry place.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of gate operators and controls.

b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

c. Deterioration of coatings beyond normal weathering.

B. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL

A. All posts and rails shall be straight, true to section and of sufficient length for proper installation.

B. Unless otherwise specified, hardware and accessories shall conform to the requirements of ASTM F626 and ASTM A123 or ASTM A153 as applicable for zinc-coating.

2.2 POSTS AND RAILS

A. Extruded steel tube, ASTM F1083 or rolled/welded tube, ASTM F1043, minimal yield strength 50,000 pounds per square inch (psi), hot dipped galvanized.

1. Extruded steel tube: Average zinc coating of 2.0 ounces per square foot (oz/ft^2) interior/exterior, ASTM F1083.

2. Rolled/welded tube: External zinc coating 1.0 oz/ft^2 with a clear polymeric overcoat, Type D interior 90% zinc-rich coating having a minimum thickness of 0.30 mils.

B. Post size per Table 1.

Table 1 – Post and Rail Sizes

Item	Fence Height	Outside Diameter, Inches	F1083 Schedule 40 weight lb/ft	F1043-IC WT-40 weight lb/ft
Line Posts	up to 8 ft.	2.375	3.65	3.12
	8 to 12 ft.	2.875	5.79	4.64
Terminal Posts	up to 8 ft.	2.875	5.79	4.64
	8 to 12 ft.	4.000	9.11	6.56
Rails		1.660	2.27	1.84

C. Truss rod shall be ⅜-inch zinc-coated steel with adjustable turnbuckles or truss tightener.

2.3 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on Drawings.

2. Mesh Size: 2 inches.

3. Selvage: Knuckled at both selvages (KK).

4. Wire Fabric

a. Zinc-Coated Steel Fabric, 9-gauge, ASTM A817, hot-dip galvanized, ASTM A392 Class 2 – 2.0 oz/ft², coated after weaving (GAW).

1) Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.

b. Polymer-Coated Steel Fabric: ASTM F668, 9-gauge core wire, 0.3 oz/ft^2 zinc-coated with Class 2b (thermally fused and bonded) PVC coating.

1) Color: Black, ASTM F934.

2.4 TENSION WIRE

A. Match coating type to that of the chain link fabric.

1. Metallic-coated steel wire: Marcelled (spiraled or crimped), 7 gage, (0.177 inches) diameter, ASTM A824, zinc-coated, ASTM A817 Class 5 – 2.0 oz/ft².

2. Polymer-coated steel wire: Marcelled (spiraled or crimped) 7 gage, (0.177 inches) diameter (before coating), ASTM F1664.

a. Color: Black, ASTM F934.

2.5 HARDWARE AND FITTINGS

A. Tension and Brace Bands: Galvanized pressed steel complying with ASTM F626, minimum steel thickness of 12 gauge (0.105 in.), minimum width of ¾ in. and minimum zinc coating of 1.20 oz/ft². Secure bands with 5⁄16 in. hot-dip galvanized steel carriage bolts.

B. Terminal Post Caps, Line Post Loop Caps, Rail and Brace Ends, Boulevard Clamps, and Rail Sleeves: In compliance to ASTM F626, pressed steel galvanized after fabrication having a minimum zinc coating of 1.20 oz/ft².

1. Rail sleeves shall not be less than 6 inches long.

C. Truss Rod Assembly: In compliance with ASTM F626, ⅜ in. diameter steel truss rod with a pressed steel tightener, minimum zinc coating of 1.2 oz/ft², assembly capable of withstanding a tension of 2,000 lbs.

D. Tension Bars: In compliance with ASTM F626. Galvanized steel one-piece length 2 in. less than the fabric height, minimum cross section of 3⁄16 in. by ¾ in. and minimum zinc coating of 1.2 oz./ft².

E. Miscellaneous hardware, including but not limited to nuts, bolts, washers, clips, bands, rail ends, brackets, and straps shall be provided as required, hot-dip galvanized steel, ASTM F626.

F. Brace bands shall be formed from flat or beveled steel and shall have a minimum thickness after galvanizing of 0.108 inches and a minimum width of ¾ inch.

G. Polymer-Coated Fittings: ASTM F626, PVC or polyolefin coating, minimum thickness 0.006 in., fused and adhered to the zinc-coated fittings. Color to match fence system.

2.6 TIE WIRE AND HOG RINGS

A. Tie Wire and Hog Rings: Galvanized minimum zinc coating 1.20 oz/ft², 9-gauge (0.148 in) steel wire, ASTM F626.

B. Polymer coated materials shall match the coating, class and color to that of the chain link fabric.

2.7 FASTENERS

A. All fasteners shall be hot-dip galvanized, ASTM F2329.

B. Bolts: Steel, ASTM A307, Grade A min, Hex.

C. Nuts: Steel, ASTM A563, Grade A min, Hex.

D. Washers: Steel, round, ASTM F844.

E. Polymer Coated Color Fittings: In compliance with ASTM F626, PVC or polyolefin coating minimum thickness 0.006 in. fused and adhered to the zinc-coated fittings. Color to match fence system.

2.8 MODULAR OR PANELIZED CHAIN LINK FENCE

A. Free-standing fence panels, minimum ten (10) foot panels of the height specified.

B. Fabric as specified.

C. Welded tubular steel frame.

D. Stands: Four-sided welded tubular steel frame with center bar and tubular sleeves.

2.9 GATES

A. Gate Construction: ASTM F900. Corners welded or assembled with special malleable or pressed-steel fittings and rivets or bolts to provide rigid connections.

B. Pipe and Tubing: Zinc-Coated Steel: Comply with ASTM F1043 and ASTM F1083; protective coating and finish to match fence framing.

C. Posts (Hing Posts): Round tubular steel.

1. Up to 4-foot fencing: 2⅞-inch OD Pipe.

2. Over 4-foot to 6-foot fencing: 4-inch OD Pipe.

3. Over 6-foot to 12-foot fencing: 6.625-inch OD Pipe.

D. Frames and Bracing: Round tubular steel.

1. Framing:

a. 2.375 inch OD Pipe

b. Gate Leaves: Configured with intermediate members and diagonal truss rods or tubular members as necessary to provide rigid construction, free from sag or twist. When width of gate leaf exceeds 10 feet, install mid-distance vertical tubing of the same size and weight as frame members. When either horizontal or vertical bracing is not required, provide truss rods as cross-bracing to prevent sag or twist.

c. Horizontal bid bracing shall be used on all gates.

E. Wire Fencing Fabric: Fabric shall match that of fence, attached securely to frame at intervals not exceeding 15 inches.

F. Hardware:

1. Latches, hinges, stops, keepers and other hardware items shall be furnished as required for proper operation. These elements may not be shown on the Drawings, but shall be supplied and installed as required for a complete gate system.

2. Hinges: 360-degree inward and outward swing. Set screw shall be installed drilled into the steel post to lock each hinge to the gate post and prevent rotation. No-lift-off type. Box type hinges are not acceptable.

3. Latches: permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

4. Double gates and single gates with leaf width 4 feet and greater shall be equipped with a minimum ½″ drop bar and gate hold-backs.

5. Latches, hinges, stops, keepers and other hardware items shall be furnished as required for proper operation.

2.10 PRIVACY SLATS (IF APPLICABLE)

A. Material: PVC, UV-light stabilized, flame resistant, four ply, not less than 0.023 inch (0.58 mm) thick; sized to fit mesh specified for direction indicated.

B. Material: Redwood, 5⁄16 inch (7.9 mm) thick, sized to fit mesh specified for direction indicated.

C. Color: As selected by Owner.

2.11 CONCRETE

A. Concrete shall conform to ASTM C94; or pre-packaged concrete mix, ASTM C387. Minimum 28-day compressive strength of 3,000 psi. No air entrainment.

2.12 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

PART 3 EXECUTION

3.1 GENERAL

A. Install fence with properly trained crew as shown on the drawings in accordance with ASTM F567.

B. Install all nuts for tension bands and hardware bolts on the side of the fence opposite the fabric.

C. The temporary chain link fence shall be removed at the conclusion of the work.

3.2 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.4 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F567 and more stringent requirements indicated.

1. Install fencing on established boundary lines inside property line.

3.5 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete post footings shall have a plan diameter 12 inches greater than the post diameter. Holes shall be clean and free of loose soil and debris. Concrete shall be placed continuously in one operation and tamped or vibrated for consolidation. Tops of the concrete footings shall be crowned to shed water.

3. Gate post/footings shall be installed a minimum of 42 inches below grade.

4. All corner, end posts, and gate posts shall be braced.

    a. 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.

    b. Corner and terminal posts are to be braced horizontally and diagonally. The braces are to extend over one adjacent panel. Changes in line of 30 degrees or more shall be considered as corners.

    c. Braces and truss rods shall be securely fastened to posts with appropriate hardware.

    d. Pull posts with two braces shall be provided for all heights where changes in horizontal or vertical alignment of ten (10) degrees or more occur.

5. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Concealed Concrete: Top 3 inches below grade as indicated on Drawings to allow covering with surface material.

    b. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

    c. Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches deep and ¾ inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

D. Line Posts: Space line posts uniformly as indicated on the Drawings. Unless indicated otherwise, spacing shall be 8 feet on-center.

E. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

    1. horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches on-center. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches (152 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.

G. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Intermediate and Bottom Rails: Install and secure to posts with fittings.

I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches on-center.

K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches on-center and to braces at 24 inches on-center.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

M. Privacy Slats: Install slats in direction indicated, securely locked in place.

1. Diagonally, for privacy factor of 80 to 85.

N. Fabric:

1. Do not install fabric until concrete post footings have cured seven (7) days. Provide fabric of the height specified. Install fabric on the public side of the fence, with bottom no greater than 2 inches above the ground surface. Fabric shall be pulled taut to prevent sagging and provide a uniform smooth appearance. Fasten fabric to line posts at intervals not exceeding 15 inches with ties as specified.

2. Install tension wire in one continuous length between pull posts, weaved through fence fabric at top. Tension wire shall be applied to provide a wire without visible sag between posts. Fasten fabric to tension wire at intervals not exceeding 24 inches with ties or hog rings as specified.

3. Where it is not practicable to conform the fence to general contour of the ground, as at ditches, channels, etc., the opening beneath the fence shall be enclosed with chain link fabric and sufficiently braced to preclude access, but not to restrict the flow of water.

3.6 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

B. Provide swing gates at the locations and dimensions shown on the Drawings. Do not install gates until concrete post footings have cured seven (7) days.

C. Gates shall be installed plumb, level, and secure, with full opening without interference. Hardware shall be installed and adjusted for smooth operation and lubricated where necessary.

D. Provide concrete center drop to footing depth and suitable drop rod sleeve at center of double gate openings.

3.7 GATE OPERATOR INSTALLATION (IF APPLICABLE)

A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation for Support Posts Pedestals Equipment Bases/Pads: Hand-excavate holes for bases/pads, in firm, undisturbed soil to dimensions and depths and at locations as required by gate-operator component manufacturer's written instructions and as indicated.

3.8 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1,500 feet except as follows:

B. Fences within 100 feet of buildings, structures, walkways, and roadways: Ground at maximum intervals of 750 feet.

1. Gates and Other Fence Openings: Ground fence on each side of opening.

2. Bond metal gates to gate posts.

3. Coordinate subparagraph below with Drawings in projects where intentional discontinuities are provided in metal fencing conductivity to localize lightning effects to the vicinity of strikes. See Evaluations.

4. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

D. Plans and details on Electrical Drawings and requirements in Division 26 Sections may revise or illustrate application of requirement below or may require grounding that exceeds minimum requirements in IEEE C2. Fences enclosing electrical substations are often bonded to a station grounding mat.

E. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

F. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:

1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.

2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

G. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

H. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

I. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

3.9 FIELD QUALITY CONTROL

A. Grounding-Resistance Testing: Engage a qualified testing agency to perform tests and inspections.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.

3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.10 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION

SECTION 32 3223

SEGMENTAL RETAINING WALLS

PART 1 GENERAL

1.1 SUMMARY

A. The work of this Section shall include engineering services in addition to the requirements associated with furnishing and constructing segmental retaining walls (SRW).

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. State of Connecticut.

1. Standard Specifications for Roads, Bridges and Incidental Construction, Form 817, 2016 and any supplements.

D. American Society for Testing and Materials (ASTM)

1. ASTM C 140 – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units

2. ASTM C 1372 – Specification for Dry-Cast Segmental Retaining Wall Units

3. ASTM D 422 – Standard Test Method for Particle-Size Analysis of Soils

4. ASTM D 698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

5. ASTM D 4318 – Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

6. ASTM D 4595 – Standard Test Method for Tensile Properties of Geotextiles by the Wide Width Strip

7. ASTM D 5262 – Standard Test Method for Evaluating Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics

8. ASTM D 3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

9. ASTM D 6706 – Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil

E. Geosynthetic Research Institute (GRI)

1. GRI-GG4a – Standard Practice for Determination of the Long-Term Design Strength of Stiff Geogrids.

2. GRI-GG4b – Standard Practice for Determination of the Long-Term Design Strength of Flexible Geogrids.

3. GRI-GT7 – Standard Practice for Determination of the Long-Term Design Strength of Geotextiles.

F. National Concrete Masonry Association

1. Design Manual for Segmental Retaining Walls, latest edition.

2. NCMA SRWU-1 Test Method for Determining Connection Strength of SRW.

3. NCMA SRWU-2 Test Method for Determining Shear Strength of SRW.

1.3 SUBMITTALS

A. Contractor is responsible for the preparation of a complete submittal package, which shall include design calculations and shop drawings. The design calculations shall include evaluation of the following potential SRW failure modes: sliding (base/internal), overturning, geogrid reinforcement overstress, geogrid reinforcement pullout (soil/block), internal compound stability, global stability and bearing capacity. The SRW design shall be performed in accordance with the "NCMA Design Manual for Segmental Retaining Walls", using the recommended minimum factors of safety in this manual. The shop drawings shall indicate all features of the complete SRW design.

B. Design calculations and shop drawings shall be sealed by a Professional Engineer, licensed in the State of Connecticut and experienced in the design of SRW.

C. Contactor shall provide an SRW capable of resisting the load effects due to the soil pressures (including the effects of sloped backfill) resulting from the finished grades shown on the Drawings, in addition to any additional external loads specified, including the minimum construction loads stipulated in the Geotechnical Engineering Report, included in the Contract Documents.

D. Contractor may vary vertical spacing between geogrid reinforcement layers, however, layer spacing shall not exceed two (2) feet. Geogrid reinforcement placement shall accommodate the curved layout geometry shown on the Drawings and shall maintain one-hundred (100) percent continuous coverage parallel to the SRW face – gapping between horizontally adjacent layers of geogrid reinforcement (partial coverage) shall not be allowed. Geogrid reinforcement shall be capable of accommodating local penetrations at the location of the black vinyl coated chain link fence post footings shown on the Drawings.

E. Contractor shall include manufacturer standard conditions and specifications for construction (acceptable to include on shop drawings). Where the manufacturer specifications differ from the Contract Documents, the manufacturer's specifications shall prevail with approval of the Engineer.

F. Product Test Reports: Indicate compliance of SRW units and geogrid reinforcement with requirements based on comprehensive testing of current products. Include test data (product cut sheets) verifying the engineering properties used in the preparation of the design calculations for each of the investigated failure modes.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. Carefully pack, band and load SRW units for shipment on wood pallets or skids. Pallets and skids shall be stacked in such a manner as to evenly distribute the weight of the SRW units and to prevent breakage, cracking, and other damage. No material, which may cause staining, or discoloration may be used for blocking, packing or dunnage. Use polyethylene or other suitable plastic to separate dissimilar materials.

2. Transportation carrier shall use appropriate methods to ensure all SRW materials are properly loaded, supported, stacked, and restrained during transport.

3. Deliver packaged materials to the site in their original, unopened package or container-bearing label clearly identifying manufacturer's name, brand name, material, weight or volume, and other pertinent information. Packaged materials shall be stored in their original, unbroken package or container in a weather-tight and dry place until ready for use.

B. Handling

1. Handle SRW units so as to prevent chipping, breakage, marring, soiling and other damage. Do not use pinch or wrecking bars without protecting edges of stone with wood or other suitable material. Cracked, badly chipped, or stained SRW units will be rejected and shall not be employed in the work.

2. Deliver materials to the site in an undamaged condition.

C. Storage

1. Store SRW units and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, or other causes.

2. Store accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.5 WARRANTY

A. Provide manufacturer’s standard warranty, as applicable, for all products furnished under this Section. Warranty shall be registered in Owner’s name.

B. Bind warranties in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

C. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.

D. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of Contractor.

E. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 PRODUCTS

2.1 SEGMENTAL RETAINING WALL (SRW) UNITS

A. SRW units shall be Redi-Scapes, a division of Redi-Rock International LLC, or equal.

B. SRW color shall be natural. Please confirm color with Owner prior to ordering SRW units.

C. Special Units: Provide corner units, end units, coping units, and other special shapes, as necessary, to produce an SRW which conforms to the approximate plan and elevation views shown on the Drawings.

D. The SRW units shall be solid units.

E. The SRW units shall have an integral shear key connection and shall be offset to the minimum wall batter per manufacturer specification.

F. Concrete used to manufacture SRW units shall have a minimum 28-day compressive strength of 3,000 psi, as determined in accordance with ASTM C 140, and a maximum moisture absorption rate, by weight, of eight (8) percent, as determined in accordance with ASTM C 1372.

2.2 SEGMENTAL RETAINING WALL (SRW) DESIGN GEOMETRY

A. The design wall height, ‘H’ and minimum SRW embedment shall be as shown on the Drawings.

B. Inclusion of live load surcharge, resulting from vehicular traffic, is not anticipated to be a design requirement, as the adjacent parking area will be reconfigured such that vehicles will not be allowed within a distance equal to one-half the SRW height behind the back face of the SRW.

2.3 SOIL REINFORCEMENT

A. A geogrid, or geotextile, reinforcement satisfying the design requirements, specifically manufactured for use as soil reinforcement and compatible with the selected SRW units, shall be furnished by one of the following manufacturers:

1. Amoco Fabrics and Fibers Co.;
2. Nicolon Corp.; Nicolon/Mirafi Group.;
3. Strata Systems, Inc.;
4. Tensar Earth Technologies, Inc.; or
5. Engineer-approved equal.

2.4 SOIL AND EARTH MATERIALS

A. Refer to Drawings.

2.5 GEOTEXTILES AND GEOMEMBRANES

A. Refer to Drawings.

2.6 DRAINAGE PIPE

A. Refer to Drawings and applicable Specifications.

PART 3 EXECUTION

3.1 GENERAL

A. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing of any hazardous conditions and/or discrepancies.

3.2 SEGMENTAL RETAINING WALL (SRW) DESIGN

A. Refer to Section 1.3 for SRW design and detailing requirements. The design life of the SRW shall be seventy-five (75) years.

3.3 EXAMINATION

A. Contractor shall examine the area to receive the SRW and evaluate the conditions under which walls will be installed for compliance with the requirements for excavation tolerances, condition of subgrades, and other conditions affecting the performance of the SRW.

1. Do not proceed with the SRW installation until unsatisfactory conditions have been corrected.

3.4 SEGMENTAL RETAINING WALL (SRW) INSTALLATION

A. Excavation: Contractor shall excavate to the approximate line and grade shown on the Drawings and shall take precautions to minimize over-excavation (except for the removal of unsuitable foundation material). Native soils from over-excavated areas shall be replaced with Structural Fill as shown on the Drawings.

B. Utilities: Contractor shall verify the location of the existing structures and utilities prior to commencing excavation activities. Contractor shall ensure all surrounding structures are protected from the effects of the SRW excavation. Excavation support, or special treatment of existing utilities discovered within the limits of the Granular Backfill for SRW, if required, is the responsibility of the Contractor.

C. Foundation Preparation: Refer to Drawings.

D. Leveling Pad: Refer to Drawings for material, geometry and construction requirements.

E. First Course: The first course of SRW units shall be placed on the prepared leveling pad, using the working point location table shown on the Drawings to establish the proper SRW alignment. Care shall be taken to ensure that the SRW units are aligned properly, leveled from side to side and front to back and are in complete contact with the leveling pad. No gaps shall

be left between the front of adjacent SRW units. All excess debris shall be cleaned from the top of the SRW units.

F. Subsequent Courses: The level and alignment of the units shall be checked and corrected, as required. Layout of curves and corners shall be installed in accordance with the approved shops drawings, and in general conformance with the SRW manufacturer guidelines. Fill voids between and within individual SRW units with manufacturer recommended drainage fill material.

G. Geogrid Reinforcement: Geogrid reinforcement shall be placed in sequence with the SRW units, drainage fill material and Granular Backfill for Segmental Retaining Wall (SRW).

1. All geogrid reinforcement shall be installed at the proper elevation and orientation as shown on the approved shop drawings and in accordance with the SRW manufacturer guidelines.

2. Geogrid reinforcement layers shall be one continuous piece for the entire embedment length. Splicing of the geogrid reinforcement in the design strength direction shall not be permitted.

3. Tracked construction equipment shall not be operated directly on the geogrid reinforcement. A minimum of six (6) inches of Granular Backfill for SRW is required prior to operation of tracked equipment over the geogrid reinforcement. Turning shall be kept to a minimum. Rubber-tired equipment may pass over the geogrid reinforcement at slow speeds (less than five (5) miles per hour).

4. Geogrid reinforcement shall be free of wrinkles prior to the placement of Granular Backfill for SRW. Nominal tension shall be applied and the geogrid reinforcement shall be secured in place with staples, stakes, or by hand tensioning until the geogrid reinforcement is covered by six (6) inches of Granular Backfill for SRW.

H. Drainage Column: Refer to Drawings for material, geometry and construction requirements.

I. Drainage Collection Pipes: Refer to Drawings for material, geometry and construction requirements.

J. Placement of Granular Backfill for Segmental Retaining Wall (SRW)

1. Granular Backfill for SRW shall be placed as shown on the approved shop drawings in a maximum lift thickness of eight (8) inches and shall be compacted to a minimum of ninety-five (95) percent of standard Proctor density (ASTM D 698) at a moisture content within two (2) percent of optimum. Granular Backfill for SRW shall be placed and spread in a manner as to eliminate wrinkles, or movement of the geogrid reinforcement and individual SRW units. Placement of Granular Backfill for SRW (and associated geogrid reinforcement) shall be coordinated with the placement of the black vinyl coated chain link fence post footings shown on the Drawings.

2. Only hand-operated compaction equipment shall be allowed within three (3) feet of the back of the SRW units. Compaction within the three (3) feet behind the SRW units shall be achieved by at least three (3) passes of a lightweight mechanical tamper, plate, or roller.

3. At the end of each shift, the Contractor shall slope the last level of Granular Backfill for SRW away from the face of the wall.

4. Following placement and compaction of the final lift of Granular Backfill for SRW, the impervious membrane and landscape treatments shall be installed as shown on the Drawings.

K. Coping Units:

1. Coping units shall be properly aligned and secured with a flexible, high strength manufacturer approved construction adhesive. Rigid adhesive, or mortar is not acceptable.

3.5 CLEAN UP

A. Contractor shall remove all debris, residuals, and materials at the conclusion of the work.

END OF SECTION

SECTION 32 4000

GUARDRAIL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Wood guardrail.

2. Furnishing required materials.

3. Assembly and installation.

B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 SUBMITTALS:

A. Submit to Engineer for approval shop drawings for materials. No materials shall be fabricated or shipped prior to approval of the shop drawings by Engineer.

B. A certificate of wood treatment shall be furnished to the Engineer upon delivery of the treated wood products. Treated wood shall bear the appropriate American Wood Preserves Bureau [AWPB] quality mark for the treatment employed. The certificate shall indicate acceptability of treated wood to receive field-applied stain.

C. Submit layout plan for single faced wood guardrail showing post locations, including end and closure posts.

1.3 QUALITY ASSURANCE

A. Posts and offset blocks that contain unsound knots and shakes, excessive checking or other defects that may be detrimental to the structural integrity of the posts and offset blocks will be rejected and shall not be used in the proposed work.

PART 2 PRODUCTS

2.1 MATERIALS:

A. Wood Guardrail

1. Rails shall be of the same timber species as the post, and shall be stress grade 1,000 psi or more, extreme fiber in bending.

2. Post and rails shall be treated with a wood preservative as specified in Article 2.1 B. Minimum net retention shall be 0.40 lbs./cubic foot.

3. Posts and rails shall be predrilled and cut to the required dimensions prior to treatment.

4. Bolt holes shall be 1/16 inch larger than bolt thread diameter.

PART 3 EXECUTION

3.1 WOOD GUARDRAIL

A. Posts shall be set in excavated holes at the required spacing. Layout spacing of posts in the field prior to excavating post holes. End and closure posts at bends shall be spaced a maximum distance of eight feet and a minimum of four feet.

B. Furnish and install post required to accommodate the steel highway guard terminal section at end post. Field bore holes to insure proper attachment of steel terminal section to wood rail and post.

C. The bottom of post holes shall be tamped to grade. Post shall be set plumb at the required location.

D. Post holes shall be backfilled with suitable material placed in layers and compacted.

E. Wood rails shall be erected to form a smooth continuous rail conforming to the required line and grade. Butt adjoining rail sections with a maximum separation between adjoining rail sections of 1/16 inch.

F. Rails shall be butt jointed at alternate posts or as directed, and shall be securely attached with galvanized carriage bolts, at least two per rail per post, of sufficient length to secure with washer and nut. Hammering or other forceful method of inserting bolt shall not be used. Rail splices and terminal section connections shall occur only at posts.

G. Wood surfaces, cut or injured, and field boxed in wood posts or rails shall be brush treated with two application of wood preservative using material of the same specifications as that used in the preservative treatment.

END OF SECTION

SECTION 32 4400

PREFABRICATED STORAGE SHED

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Procurement and installation of a prefabricated storage shed configured as specified herein and as shown on the Drawings.

B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. State of Connecticut

1. 2016 Connecticut State Building Code, including all Amendments, Supplements, and Errata.

1.3 SUBMITTALS

A. Material certificates or other data indicating compliance with these Specifications for size, style, layout, configuration, materials of construction, finish type, color, hardware, and accessories.

B. Copies of manufacturer-provided installation instructions, operation instructions, and maintenance material for all items furnished under this Section.

C. Manufacturer’s warranties and associated warranty registration data in Owner’s name. Submit two (2) copies of each warranty to Engineer in the manufacture’s/supplier’s standard form or if there is no standard form available, in a form specified by Engineer.

1.4 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 this Section.

B. Prefabricated shed manufacturer shall assist Contractor by providing all information needed to assist in obtaining all permits necessary for construction/installation on the Project Site.

C. Provide factory built, prefabricated storage shed capable of withstanding the effects of gravity loads, wind loads, and other loads and stresses within limits required by state and local codes and ordinances.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage

1. Transportation carrier shall use appropriate methods to ensure storage shed is properly packaged and restrained during transport.

2. Protect storage shed and associated appurtenances during storage against moisture, soiling, staining, and physical damage.

3. Any product or associated component showing manufacturing flaws upon receipt at the Project Site shall be referred to Engineer for determination as to whether it shall be repaired, rejected, or used.

B. Handling

1. Handle all materials to prevent abrasion, chipping, marring, soiling and other damage.

2. Damaged materials shall not be installed. Contractor shall bear responsibility for damage to materials until final acceptance by Owner. Any installed materials exhibiting damage shall be replaced or repaired to the satisfaction of Engineer, and Contractor shall assume all costs related thereto.

1.6 WARRANTY

A. Provide manufacturer's standard warranty, as applicable, for all products furnished under this Section. Warranty shall be registered in Owner's name.

B. Bind warranties in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½-by-11-inch paper.

C. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.

D. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of Contractor.

E. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 PRODUCTS

2.1 PREFABRICATED STORAGE SHED

A. General

1. Size: 14 feet by 28 feet.

2. Configuration and Style: As indicated on the Drawings.

3. Location: As indicated on the Drawings.

B. Doors:

1. One overhead door (end), roll-up style, locking, simulated carriage door style with handles and decorative hinges as indicated on the Drawings. Weather stripping as required. Color: White. Trim: solid vinyl plank, color as selected by Owner.

2. One door (side) as indicated on the Drawings, locking, no windows, decorative tamper-proof hinges (3), weather stripping as required. Color: To match siding. Trim: solid vinyl plank, color as selected by Owner.

C. Roof

1. 2-inch by 4-inch kiln-dried Douglas Fir framing lumber, 16-inches on-center with double plywood gussets at peak. Pitch as selected by Owner.

2. Sheathing: 1/2-inch CDX plywood.

3. Drip edge: Pre-formed aluminum.

4. Shingles: Asphalt or fiberglass, self-sealing, architectural. Minimum 25-year (min) warranty.

5. Fascia: 6-inch overhang, fully finished, sheet vinyl, color as selected by Owner.

6. Soffits: 6-inch overhang, fully finished, sheet vinyl, color as selected by Owner.

7. Cupola: Square configuration with simulated vents or windows as indicated on the Drawings, color as selected by Owner; copper sheathed cap section with protective clear finish and rotating weathervane.

8. Flashing, fasteners, brackets, straps, and accessories: Per applicable codes.

D. Vents

1. Location: each end, below peak.

2. Style: Louvered with frame and insect screen.

3. Material: vinyl or aluminum.

4. Size: Minimum 8"x14".

E. Framing

1. Studs: 2-inch by 4-inch kiln-dried Douglas Fir framing lumber, 16-inches on-center. Jacks and headers at doors per applicable codes.

2. Sill Plate: 2-inch by 4-inch kiln-dried Douglas Fir framing lumber, all four sides. Break at doors.

3. Floor Joists: 2-inch by 8-inch kiln-dried framing lumber, pressure treated (ACQ, CA, or MCA), 12-inches on-center.

4. Flashing, fasteners, brackets, straps, and accessories: Per applicable codes.

F. Floor: 3/4-inch pressure-treated (ACQ, CA, or MCA) plywood, tongue and groove.

G. Siding

1. Sheathing: 1/2-inch CDX plywood.

2. Vinyl, simulated cedar shakes. Color: As selected by Owner.

3. Corners: Solid vinyl plank, color as selected by Owner.

H. Foundation Beams: 4-inch by 4-inch beams, pressure treated (ACQ, CA, or MCA). 7 beams minimum.

I. Paint: latex/acrylic exterior paint. Color by Owner.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with shed supplier for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install shed base materials as indicated on the Drawings.

B. Comply with manufacturer's written installation instructions, unless more stringent requirements are indicated. Complete field assembly of items where required.

C. Install items per manufacturer's recommendations and at locations approved by Owner.

D. Provide for all required leveling and adjusting. Provide for code-compliant anchoring as required.

E. Provide two sets of keys to Owner.

3.3 PROTECTION AND CLEAN UP

A. After completing installation, inspect components. Remove spots, dirt, and debris.

B. Protect until acceptance of project. Repair any damaged finishes to match original finish or replace component.

END OF SECTION

SECTION 32 9000

PLANTING

PART 1 GENERAL

1.1 SUMMARY

A. Provide all labor, materials, equipment, services, and perform all operations necessary to complete the work of this section as indicated within the drawings and specified herein which shall include, but is not limited to, the following:

1. Supplying Trees, Shrubs, Perennial, and Groundcover

2. Mulch

3. Maintenance including watering

4. Warranty

B. The contractor is responsible for all health and safety.

1.2 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than sizes indicated; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than sizes indicated.

D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

G. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

H. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

I. Planting Area: Areas to be planted.

J. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

K. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

L. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

1.3 SUBMITTALS

A. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

1. Plant Photographs: Include color photographs in 3- by 5-inch print format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.

1. Contractor shall follow all Connecticut DEEP regulations for pesticide and herbicide applications.

C. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

D. Product Data: For each type of product indicated, including soils.

E. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Submit material specifications, manufacturer's literature and installation instructions where applicable attesting that the following materials meet the requirements specified:

a. Fertilizer

b. Anti-Desiccant

c. Mulch

d. Soil Amendments

e. Edging

f. Weed Control Barrier

2. Manufacturer's certified analysis of standard products.

3. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

F. Maintenance Manual

1. The landscape contractor shall submit a written manual, prepared for the Owner that outlines a schedule for proper maintenance of the plantings. This schedule should include timing and methods for watering, fertilization, mulching, pruning and other maintenance operations to be conducted after the three month maintenance contract period.

G. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants including the preparation, mixing and installation of soil mixes to support planting.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.

2. Experience: Five years' experience in landscape installation of size and scope similar to this project.

3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

a. Certified Landscape Technician – Exterior, with installation maintenance specialty area(s), designated CLT-Exterior.

b. Certified Landscape Technician – Interior, designated CLT-Interior.

c. Certified Ornamental Landscape Professional, designated COLP.

5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not

measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.

2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.

E. Preinstallation Conference: Conduct conference at Project site.

F. Work to be done shall be coordinated with all other trades on site. Work includes furnishing all labor, materials, equipment and services required to complete all planting indicated on the drawings, as specified in this section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

C. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

E. Handle planting stock by root ball.

F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

G. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.

2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.

3. Do not remove container-grown stock from containers before time of planting.

4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:

1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of each service or utility.

2. Do not proceed with interruption of services or utilities without Construction Manager's written permission.

C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring:

a. Deciduous materials: March 1 to May 15

b. Evergreen Materials: March 1 to June 1

2. Fall:

a. Deciduous materials: From September 1 until the ground freezes.

b. Evergreen Materials: August 15–October 15

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.7 PLANT WARRANTY

A. Plant Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.

b. Structural failures including plantings falling or blowing over.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods from Date of Substantial Completion:

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months

b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months

c. Annuals: Three months

3. When the work is accepted in parts, the warranty periods shall extend from each of the partial Substantial Completion Acceptances to the terminal date of the last warranty period. Thus, all warranty periods for each class of plant warranty, shall terminate at one time.

4. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.

b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.

d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

5. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this specification. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.

1.8 MAINTENANCE SERVICE

A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until substantial completion but for not less than maintenance period below if substantial complete comes earlier.

1. Maintenance Period: Three months from date of planting completion.

B. Initial Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until substantial completion but for not less than maintenance period below if substantial completion comes earlier.

1. Maintenance Period: Three months from date of planting completion.

C. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.9 PLANT SUBSTITUTIONS FOR PLANTS NOT AVAILABLE

A. Submit all requests for substitutions of plant species, or size to the Owner's Representative, for approval, prior to purchasing the proposed substitution. Request for substitution shall be accompanied with a list of nurseries contacted in the search for the required plant and a record of other attempts to locate the required material. Requests shall also include sources of plants found that may be of a smaller or larger size, or a different shape or habit than specified, or plants of the same genus and species but different cultivar origin, or which may otherwise not meet the requirements of the specifications, but which may be available for substitution.

PART 2 PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated on the Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than ¾ inch in diameter; or with stem girdling roots will be rejected.

2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label at least one plant of each variety, size, and caliper in each planting bed with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

E. If formal arrangements or consecutive order of plants is shown on the Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

F. Annuals: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

G. Plant List: If there is any discrepancy between quantities shown on the Plant Schedule and work shown on the drawings, the Landscape Contractor shall supply the plants necessary to complete the work as intended on the drawings. Where the size of a plant on the Plant Schedule is a variation between a minimum and maximum dimension, the sizes of the plants furnished will be equal to the average of the two dimensions. Where a single dimension is given, this dimension represents the minimum size of the plants to be furnished.

2.2 PLANTING SOIL

A. See Specification Section 32 9100 – Planting Soil

2.3 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, perennials and groundcovers, consisting of one of the following:

1. Type: Aged double-shredded bark.

2. Size Range: 2 inches maximum, ½ inch minimum.

3. Depth: As shown on the drawings.

4. Color: Natural.

2.4 PESTICIDES

General: For turf and ornamental areas, including trees, onlt pesticides that are exempt from EPA registration requirements can be applied on the grounds of public schools with students in grades k through 8. For grades 9 and up, the contractor shall follow the Board of Educations' pest control policy and notification requirements.

A. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

B. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.5 WATERING BAGS

A. Plastic tree watering bags holding a minimum of 15 gallons of water and with a slow drip hole(s) water release system, specifically designed to water establishing trees. Water should release over a several day period, not within a few hours.

B. Watering bags shall be:

1. Treegator Irrigation Bags sized to the appropriate model for the requirements of the plant, manufactured by Spectrum Products, Inc., Youngsville, NC 27596.

2. Ooze Tube sized to the appropriate model for the requirements of the plant, manufactured by Engineered Water Solutions, Atlanta, GA.

3. Or approved equal.

C. Submit manufacturer's product data for approval.

2.6 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Burlap: Non-synthetic, biodegradable.

C. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine the surface grades and soil conditions to confirm that the requirements of the Specification Section – Planting Soil – and the soil and drainage modifications indicated on the Planting Soil Plan and Details (if applicable) have been completed. Notify the Owner's Representative in writing of any unsatisfactory conditions.

B. Planting shall only be performed when weather and soil conditions are suitable for planting the materials specified in accordance with locally accepted practice. Install plants during the planting time as described below unless otherwise approved in writing by the Owner's Representative. In the event that the Contractor request planting outside the dates of the planting season, approval of the request does not change the requirements of the warranty.

3.2 LAYOUT AND PLANTING SEQUENCE

A. Relative positions of all plants and trees are subject to approval of the Owner's Representative.

B. Notify the Owner's Representative, one (1) week prior to layout. Layout all individual tree and shrub locations. Place plants above surface at planting location or place a labeled stake at planting location. Layout bed lines with paint for the Owner's Representative's approval. Secure the Owner's Representative's acceptance before digging and start of planting work.

C. When applicable, plant trees before other plants are installed.

D. It is understood that plants are not precise objects and that minor adjustments in the layout will be required as the planting plan is constructed. These adjustments may not be apparent until some or all of the plants are installed. Make adjustments as required by the Landscape Architect including relocating previously installed plants.

3.3 SOIL PROTECTION DURING PLANT DELIVERY AND INSTALLATION

A. Protect soil from compaction during the delivery of plants to the planting locations, digging of planting holes and installing plants.

1. Where possible deliver and plant trees that require the use of heavy mechanized equipment prior to final soil preparation and tilling. Where possible, restrict the driving lanes to one area instead of driving over and compacting a large area of soil.

2. Till to a depth of 6 inches, all soil that has been driven over during the installation of plants

3.4 SOIL MOISTURE

A. Volumetric soil moisture level, in both the Planting Soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilt point and below field capacity for each type of soil texture within the following ranges.

Soil Texture	Permanent Wilting Point	Field Capacity
Sand, Loamy sand, Sandy loam	5–8%	12–18%
Loam, Sandy clay, Sandy clay loam	14–25%	27–36%
Clay loam, Silt loam	11–22%	31–36%
Silty clay, Silty clay loam	22–27%	38–41%

B. The Contractor shall confirm the soil moisture levels with a moisture meter (Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent). If moisture is found to be too low, the planting holes shall be filled with water and allowed to drain before starting any planting operations. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

3.5 INSTALLATION OF PLANTS – GENERAL

A. Observe each plant after delivery and prior to installation for damage of other characteristics that may cause rejection of the plant. Notify the Owner's Representative of any condition observed.

B. Excavation of the Planting Space: Using hand tools or tracked mini-excavator, excavate the planting hole into the Planting Soil to the depth of the root ball measured after any root ball

modification to correct root problems, and wide enough for working room around the root ball or to the size indicated on the drawing or as noted below.

1. For trees and shrubs planted in soil areas that are NOT tilled or otherwise modified to a depth of at least 12 inches over a distance of more than 10 feet radius from each tree, or 5 feet radius from each shrub, the soil around the root ball shall be loosened as defined below or as indicated on the drawings.

    a. The area of loosening shall be a minimum of 3 times the diameter of the root ball at the surface sloping to 2 times the diameter of the root ball at the depth of the root ball.

    b. Loosening is defined as digging into the soil and turning the soil to reduce the compaction. The soil does not have to be removed from the hole, just dug, lifted and turned. Lifting and turning may be accomplished with a tracked mini excavator, or hand shovels.

C. If an auger is used to dig the initial planting hole, the soil around the auger hole shall be loosened as defined above for trees and shrubs planted in soil areas that are NOT tilled or otherwise modified.

D. The measuring point for root ball depth shall be the average height of the outer edge of the root ball after any required root ball modification.

E. If motorized equipment is used to deliver plants to the planting area over exposed planting beds, or used to loosen the soil or dig the planting holes, all soil that has been driven over shall be tilled to a depth of 6 inches.

F. For trees to be planted in prepared Planting Soil that is deeper than the root ball depth, compact the soil under the root ball using a mechanical tamper to assure a firm bedding for the root ball. If there is more than 12 inches of planting soil under the root ball excavate and tamp the planting soil in lifts not to exceed 12 inches.

G. Set top outer edge of the root ball at the average elevation of the proposed finish. Set the plant plumb and upright in the center of the planting hole. The tree graft, if applicable, shall be visible above the grade. Do not place soil on top of the root ball.

H. The Owner's Representative or Landscape Architect may request that plants orientation be rotated when planted based on the form of the plant.

I. Backfill the space around the root ball with the same planting soil or existing soil that was excavated for the planting space.

J. Brace root ball by tamping Planting Soil around the lower portion of the root ball. Place additional Planting Soil around base and sides of ball in six-inch (6″) lifts. Lightly tamp each lift using foot pressure or hand tools to settle backfill, support the tree and eliminate voids. DO NOT over compact the backfill or use mechanical or pneumatic tamping equipment. Over compaction shall be defined as greater than 85% of maximum dry density, standard proctor when the volumetric soil moisture is lower than field capacity.

1. When the planting hole has been backfilled to three quarters of its depth, water shall be poured around the root ball and allowed to soak into the soil to settle the soil. Do not flood the planting space. If the soil is above field capacity, allow the soil to drain to below field

capacity before finishing the planting. Air pockets shall be eliminated and backfill continued until the planting soil is brought to grade level.

K. Where indicated on the drawings, build a three-inch-high, level berm of Planting Soil around the outside of the root ball to retain water. Tamp the berm to reduce leaking and erosion of the saucer.

L. Thoroughly water the Planting Soil and root ball immediately after planting.

M. Remove all nursery plant identification tags and ribbons.

N. Remove corrugated cardboard trunk protection after planting.

3.6 TREE, SHRUB, AND VINE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare flush with adjacent finish grades.

1. Use planting soil for backfill.

2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.

3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Set container-grown stock plumb and in center of planting pit or trench with root flare flush with adjacent finish grades.

1. Use planting soil for backfill.

2. Carefully remove root ball from container without damaging root ball or plant.

3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Set and support bare-root stock in center of planting pit or trench with root flare flush with adjacent finish grade.

1. Use planting soil for backfill.

2. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots.

3. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside soil-covered roots about 1 inch from root tips; do not place tablets in bottom of the hole or touching the roots.

4. Continue backfilling process. Water again after placing and tamping final layer of soil.

F. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.7 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.8 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated in even rows with triangular spacing.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING BED FINISHING

A. After planting, smooth out all grades between plants before mulching.

B. Separate the edges of planting beds and lawn areas with a smooth, formed edge cut into the turf with the bed mulch level slightly lower, 1 and 2 inches, than the adjacent turf sod or as directed by the Owner's Representative. Bed edge lines shall be as depicted on the Drawings.

3.10 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with four-foot radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.

2. Organic Mulch in Planting Areas: Apply 2-inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.11 WATERING

A. The Contractor shall be fully responsible to ensure that adequate water is provided to all plants from the point of installation until the date of Substantial Completion Acceptance. The Contractor shall adjust the automatic irrigation system, if available, and apply additional or adjust for less water using hoses as required.

B. Hand water root balls of all plants to assure that the root balls have moisture above wilt point and below field capacity. Test the moisture content in each root ball and the soil outside the root ball to determine the water content.

C. The Contractor shall install 15 gallon watering bag for each tree to be maintained and used for tree watering during the warranty period.

D. The watering bags shall remain the property of the Owner at the completion of the work.

3.12 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

D. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

3.13 PLANT MAINTENANCE PRIOR TO SUBSTANTIAL COMPLETION

A. During the project work period and prior to Substantial Completion Acceptance, the Contractor shall maintain all plants.

B. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

C. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

D. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.14 SUBSTANTIAL COMPLETION ACCEPTANCE

A. Upon written notice from the Contractor, the Owners Representative shall review the work and make a determination if the work is substantially complete.

1. Notification shall be at least 7 days prior to the date the contractor is requesting the review.

B. The date of substantial completion of the planting shall be the date when the Owner's Representative accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.

C. The Plant Warranty period begins at date of written notification of substantial completion from the Owner's Representative. The date of substantial completion may be different than the date of substantial completion for the other sections of the project.

3.15 END OF WARRANTY FINAL ACCEPTANCE

A. At the end of the Warranty period the Owner's Representative shall observe the work and establish that all provisions of the contract are complete and the work is satisfactory.

B. If the work is satisfactory, the maintenance period will end on the date of the final observation.

C. If the work is deemed unsatisfactory, the maintenance period will continue at no additional expense to the Owner until the work has been completed, observed, and approved by the Owner's Representative.

END OF SECTION

SECTION 32 9100

PLANTING SOIL

PART 1 GENERAL

1.1 SUMMARY

A. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of Planting Soil and/or the modification of existing site soil for use as Planting Soil, complete as shown on the drawings and as specified herein.

1. Supplying and placing Planting Soil and soil amendments

2. Modifying existing stockpiled topsoil suitable for Planting Soil

3. Fine grade Planting Soil

4. Clean up and disposal of all excess and surplus material.

B. The contractor is responsible for all health and safety.

1.2 DEFINITIONS

A. Amendment: material added to Topsoil to produce Planting Soil Mix. Amendments are classified as general soil amendments, fertilizers, biological, and pH amendments.

B. Biological Amendment: Amendments such as Mycorrhizal additives, compost tea or other products intended to change the soil biology.

C. Compacted soil: soil where the density of the soil is greater that the threshold for root limiting, and further defined in this specification.

D. Compost: well decomposed stable organic material as defined by the US Composting Council and further defined in this specification.

E. Drainage: The rate at which soil water moves through the soil transitioning the soil from saturated condition to field capacity. Most often expressed as saturated hydraulic conductivity (Ksat; units are inches per hour).

F. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

G. Existing Soil: Mineral soil existing at the locations of proposed planting after the majority of the construction within and around the planting site is completed and just prior to the start of work to prepare the planting area for soil modification and/or planting, and further defined in this specification.

H. Fertilizer: amendment used for the purpose of adjusting soil nutrient composition and balance.

I. Fine grading: The final grading of the soil to achieve exact contours and positive drainage, often accomplished by hand rakes or drag rakes other suitable devices, and further defined in this specification, and further defined in this specification.

J. Finished grade: surface or elevation of Planting Soil after final grading and 12 months of settlement of the soil, and further defined in this specification.

K. Installed soil: Planting soil and existing site soil that is spread and or graded to form a planting soil, and further defined in this specification.

L. Owner's Representative: The person or entity, appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.

M. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

N. Planting Area: Areas to be planted.

O. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

P. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

Q. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

R. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

S. Scarify: Loosening and roughening the surface of soil and sub soil prior to adding additional soil on top, and further defined in this specification.

T. Soil Fracturing: Deep loosening the soil to the depths specified by using a backhoe, and further defined in this specification.

U. Undisturbed soil: Soils with the original A horizon intact that have not been graded or compacted. Soils that have been farmed, subjected to fire or logged but not graded, and natural forested land will be considered as undisturbed.

1.3 SUBMITTALS

A. Product data and certificates: For each type of manufactured product, submit data and certificates that the product meets the specification requirements, signed by the product manufacturer, and complying with the following:

B. Submit manufacturers or supplier's product data and literature certified analysis for standard products and bulk materials, complying with testing requirements and referenced standards and specific requested testing.

C. For each Compost product submit the following analysis by a recognized laboratory:

1. pH
2. Soluble Salts (Electrical Conductivity)
3. Moisture Content Percent; wet weight basis
4. Particle Size
5. Stability
6. Maturity
7. Physical Contaminants
8. US EPA Class A Standard

D. For Coarse Sand product submit the following analysis by a recognized laboratory:

1. pH
2. Particle Size distribution (percent passing) the following sieve sizes: ⅜ inch, No. 4, No. 8, No. 16, No. 30, No. 50, No. 100, No. 200

E. Samples: Submit samples of each product and material, where required by Part 2 of the specification, to the Owner's Representative for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only.

1. Submit samples a minimum of 8 weeks prior to the anticipated date of the start of soil installation.
2. Samples of all Topsoil, Coarse Sand, Compost and Planting Soil shall be submitted at the same time as the particle size and physical analysis of that material.

F. Soil Tests for existing in-place or stripped and stockpiled topsoil, existing site soil to be modified as planting soil and planting soil mixes.

1. Topsoil, existing site soil and Planting Soil Mix testing: Submit soil test analysis report for each sample of Topsoil, existing site soil and Planting Soil from an approved soil-testing laboratory and where indicated in Part 2 of the specification as follows:
    a. Submit Topsoil, Compost, and Coarse Sand for testing at least 8 weeks before scheduled installation of Planting Soil Mixes. Submit Planting Soil Mix test no more than 2 weeks after the approval of the Topsoil, Compost and Coarse Sand. Do not submit to the testing laboratory, Planting Soil Mixes, for testing until all Topsoil, Compost and Coarse Sand have been approved.
    b. If tests fail to meet the specifications, obtain other sources of material, retest and resubmit until accepted by the Owner's Representative.
    c. All soil testing will be at the expense of the Contractor.

d. Provide a mechanical gradation (sieve analysis) and USDA soil texture analysis. Soil testing of Planting Soil Mixes shall also include USDA gradation (percentage) of gravel, coarse sand, medium sand, and fine sand in addition to silt and clay.

e. Provide test results for the following soil properties:

1) pH

2) Percent organic content

3) Nutrient levels by parts per million including: phosphorus, potassium, magnesium, manganese, iron, zinc and calcium. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the soil for optimum growth of the plantings specified.

4) Soluble salt by electrical conductivity of a 1:2 soil water sample measured in Milliohm per cm.

5) Cation Exchange Capacity (CEC).

G. Provide a particle size analysis (% dry weight) and USDA soil texture analysis. Soil testing of Planting Soil Mixes shall also include USDA gradation (percentage) of gravel, coarse sand, medium sand, and fine sand in addition to silt and clay.

H. Qualification Data: For qualified Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: The installer shall be a firm having at least 5 years of experience of a scope similar to that required for the work, including the preparation, mixing and installation of soil mixes to support planting. The installer of the work in Section 32 9000 Planting, shall be the same firm installing the work in this section.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.

2. Experience: Five years' experience in landscape installation of size and scope similar to this project.

3. Installer's field supervisor shall have a minimum of five years experience as a field supervisor installing soil, shall be trained and proficient in the use of field surveying equipment to establish grades and can communicate in English with the Owner's Representative.

4. The installer's crew shall be experienced in the installation of Planting Soil, plantings, and irrigation (where applicable) and interpretation of planting plans, soil installation plans, and irrigation plans (where applicable).

B. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed. Geotechnical engineering testing labs shall not be used.

1. All testing shall be performed by the same soil lab that performed the original soil testing.

2. Testing results shall be within 10% plus or minus of the values measured in the approved Planting Soil Mixes.

3. Any Planting Soil that fails to meet the above criteria, if requested by the Owner's Representative, shall be removed and new soil installed

4. Report suitability of tested soil for plant growth.

    a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.

C. Density Tests: In-place density testing is required in all areas. Placed planting soils must be inspected for compaction level by the soil scientist or by the following: ASTM D1556 Density of Soil and Rock In Place Using Sand Cone Method, ASTM D6398-10 Nuclear Methods or ASTM D2167-08 Rubber Balloon method. ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. In-place density tests shall be carried out at a rate of one test per 1,000 square feet for each type of material placed.

1. Acceptable Compaction: Good rooting anticipated, but increasing settlement expected as compaction is reduced and/or in soil with a high organic matter content.

    a. Standard Proctor Method – 75–85%; soil below 75% is unstable and will settle excessively.

2. Root limiting Compaction: Root growth is limited with fewer, shorter and slower growing roots.

    a. Standard Proctor Method – above approximately 85%.

3. Excessive Compaction: Roots not likely to grow but can penetrate soil when soil is above field capacity.

    a. Standard Proctor Method – Above 90%.

D. Work to be done shall be coordinated with all other trades on site. Work includes furnishing all labor, materials, equipment and services required to complete all planting indicated on the drawings, as specified in this section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect soil and soil stockpiles, including the stockpiles at the soil blender's yard, from wind, rain and washing that can erode soil or separate fines and coarse material, and contamination by chemicals, dust and debris that may be detrimental to plants or soil drainage. Cover stockpiles with plastic sheeting or fabric at the end of each workday.

B. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.6 PROJECT CONDITIONS

A. It is the responsibility of the Contractor to be aware of all surface and subsurface conditions, and to notify the Owner's Representative, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Weather Limitations: Proceed with soil installation only when existing and forecasted weather conditions permit soil installation to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and requirements.

C. Do not mix, deliver, place or grade soils when frozen or with moisture above field capacity.

PART 2 PRODUCTS

2.1 TOPSOIL

A. Topsoil definition: Fertile, friable soil containing less than 5% total volume of the combination of subsoil, refuse, roots larger than 1 inch diameter, heavy, sticky or stiff clay, stones larger than 2 inches in diameter, noxious seeds, sticks, brush, litter, or any substances deleterious to plant growth. The percent (%) of the above objects shall be controlled by source selection not by screening the soil. Topsoil shall be suitable for the germination of seeds and the support of vegetative growth. Imported Topsoil shall not contain weed seeds in quantities that cause noticeable weed infestations in the final planting beds. Imported Topsoil shall meet the following physical and chemical criteria:

1. Soil texture: ASTM 422, USDA loam, sandy clay loam or sandy loam with clay content between 15 and 25% and a combined clay/silt content of no more than 55%.

2. pH value shall be between 5.5 and 7.0.

3. Percent organic matter (OM): 2.0–5.0%, by dry weight.

4. Soluble salt level: Less than 2 mmho/cm

5. Soil chemistry suitable for growing the plants specified.

B. Imported Topsoil shall be a harvested soil from fields or development sites. The organic content and particle size distribution shall be the result of natural soil formation. Manufactured soils where Coarse Sand, Composted organic material or chemical additives has been added to the soil to meet the requirements of this specification section shall not be acceptable.

C. Stockpiled Existing Topsoil at the site meeting the above criteria may be acceptable.

2.2 COMPOST

A. Organic Matter for amending planting soils shall be a stable, humus-like material produced from the aerobic decomposition and curing of Leaf Yard Waste Compost, composted for a minimum of one year (12 months). The leaf yard waste compost shall be free of debris such as plastics, metal, concrete or other debris. The leaf yard waste compost shall be free of stones larger than 3\8″, larger branches and roots. Wood chips over 1″ in length or diameter shall be removed by screening. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests.

Parameter	Range
pH	6.5 to 7.4
Soluable Salt	<2.5 mmhos/cm(dS/m)
Moisture	30–60%
Organic Matter	20% Minimum (Dry Weight)
Particle Size	100% passing ½ inch screen Max. 3% passing 0.002mm
Stability	>80% relative to positive control
Maturity	>80% (>6 on Solvita Scale)
Biological Contaminants	Meet or exceed US EPA Class A, CFR 503.32(a) levels

2.3 COURSE SAND

A. Clean, washed, sand, free of toxic materials

B. Coarse concrete sand, ASTM C33 Fine Aggregate, with a Fines Modulus Index of 2.8 and 3.2.

C. Coarse Sands shall be clean, sharp, uniformly graded medium to Coarse Sands free of limestone, shale and slate particles. Manufactured Coarse Sand shall not be permitted.

D. pH shall be lower than 7.5.

E. Provide Coarse Sand with the following particle size distribution:

Sieve Size	Percent Passing
⅜ inch	100
No. 4	95–100
No. 8	80–100
No. 16	50–85
No. 30	25–60
No. 50	10–30
No. 100	0–8
No. 200	0–5

F. The ratio of the particle size for 70 percent passing (D70) to the particle size for 20 percent passing (D20) shall be 3.0 or less.

2.4 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.

2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.

3. Provide lime in form of ground dolomitic limestone or calcitic limestone depending on recommendations from soil analysis.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

H. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.5 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 5-gram tablets.

2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

F. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

2.6 PLANTING SOIL MIXES

A. General definition: Mixes of Existing Soil or Imported Topsoil, Coarse Sand, and Compost to make a new soil that meets the project goals for the indicated planting area. These may be mixed off site or onsite, and will vary in Mix components and proportions as indicated.

B. Tree & Shrub Planting Soil: shall consist of a combination of approximately equal parts by volume Topsoil, Coarse Sand and Compost (1T:1S:1C).

1. The final mix shall have an organic content between 5 percent and 7 percent by weight.

2. The final mix shall have a hydraulic conductivity of not less than 1.5 inches per hour, ASTM D5856, when compacted to a minimum of 86 percent Standard Proctor, ASTM 698.

3. At the time of final grading, add fertilizer if required to the Planting Soil at rates recommended by the testing results for the plants to be grown.

C. Lawn Soil: Topsoil, Sand and Compost, each as specified above, shall be combined in an approximate mix ratio of two parts by volume Sand to one part by volume Topsoil to one part by volume Compost (2S:1T:1C) to create a uniform blend which meets the following requirements.

1. The final mix shall have an organic content between 4.5 percent and 5.5 percent by weight.

2. The final mix shall have a hydraulic conductivity of not less than 3.0 inches per hour, ASTM D5856, when compacted to a minimum of 88 percent Standard Proctor, ASTM 698.

3. pH shall be between 6.2 and 6.8.

4. At the time of final grading, add fertilizer if required to the Planting Soil at rates recommended by the testing results for the plants to be grown.

2.7 MISCELLANEOUS PRODUCTS

A. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to installation of Planting Soil, examine site to confirm that existing conditions are satisfactory for the work of this section to proceed.

1. Confirm that the subgrade is at the proper elevation and compacted as required.

2. Confirm that all surface areas to be filled with Planting Soil are free of construction debris, refuse, compressible or biodegradable materials, stones greater than 2 inches diameter, soil crusting films of silt or clay that reduces or stops drainage from the Planting Soil into the subsoil; and/or standing water. Remove unsuitable material from the site.

3. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

4. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

5. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

6. Confirm that utility work has been completed per the drawings.

B. If unsatisfactory conditions are encountered, notify the Owner's Representative immediately to determine corrective action before proceeding.

C. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

E. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope approximately parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.

D. In areas where Planting Soil is to be spread, confirm subgrade has been scarified.

E. The Contractor shall coordinate with all other work that may impact the completion of the work.

3.3 SOIL MOISTURE

A. Volumetric soil moisture level, in both the Planting Soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilt point and below field capacity for each type of soil texture within the following ranges.

Soil texture	Permanent wilting point	Field capacity
Sand, Loamy sand, Sandy loam	5–8%	12–18%
Loam, Sandy clay, Sandy clay loam	14–25%	27–36%
Clay loam, Silt loam	11–22%	31–36%
Silty clay, Silty clay loam	22–27%	38–41%

B. The Contractor shall confirm the soil moisture levels with a moisture meter (Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent). If moisture is found to be too low, the planting holes shall be filled with water and allowed to drain before starting any planting operations. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

3.4 MIXING OF PLANTING SOIL MIXES

A. Soil blends shall be produced with equipment that blends together each component in a thorough and uniform manner. This may be accomplished by a minimum of three handling events on a hard surfaced area with earth moving equipment or by alternately passing soil components through a screener.

3.5 PLANTING SOIL INSTALLATION

A. All equipment utilized to install or grade Planting Soils shall be wide track or balloon tire machines rated with a ground pressure of 4 psi or less. All grading and soil delivery equipment shall have buckets equipped with 6 inch long teeth to scarify any soil that becomes compacted.

B. In areas of soil installation above existing subsoil, scarify the subgrade material prior to installing Planting Soil.

1. Scarify the subsoil of the subgrade to a depth of twelve inches with the teeth of the back hoe or loader bucket, tiller or other suitable device.

2. Immediately install the Planting Soil. Protect the loosened area from traffic. DO NOT allow the loosened subgrade to become compacted.

3. In the event that the loosened area becomes overly compacted, loosen the area again prior to installing the Planting Soil.

C. Install the Planting Soil in eight inch lifts to the required depths. Apply compacting forces to each lift as required to attain the required compaction. Scarify the top of each lift prior to adding more Planting Soil by dragging the teeth of a loader bucket or backhoe across the soil surface to roughen the surface.

D. Phase work such that equipment to deliver or grade soil does not have to operate over previously installed Planting Soil. Work in rows of lifts the width of the extension of the bucket on the loader. Install all lifts in one row before proceeding to the next. Work out from the furthest part of each bed from the soil delivery point to the edge of the each bed area.

E. Where possible place large trees first and fill Planting Soil around the root ball.

F. Installing soil with soil or mulch blowers or soil slingers shall not be permitted due to the over mixing and soil ped breakdown caused by this type of equipment.

G. Where travel over installed soil is unavoidable, limit paths of traffic to reduce the impact of compaction in Planting Soil. Each time equipment passes over the installed soil it shall reverse out of the area along the same path with the teeth of the bucket dropped to scarify the soil. Comply with the paragraph "Compaction Reduction" in the event that soil becomes over compacted.

H. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

I. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

J. Application of Mycorrhizal Fungi: As recommended my manufacturer.

3.6 COMPACTION REQUIREMENTS OF INSTALLED PLANTING SOIL

A. Installed Planting Soil Mix and re-spread existing soil shall have a soil density through the required depth of the installed layers of soil and comply with the following:

1. Tree and Shrub Planting Soil: 82–85 percent Standard Proctor, ASTM D698.

2. Lawn Soil: 84–86 percent Standard Proctor, ASTM D698.

B. Planting Soil compaction shall be tested at each lift.

C. Maintain moisture conditions within the Planting Soil during installation or modification to allow for satisfactory compaction. Suspend operations if the Planting Soil becomes wet. Apply water if the soil is overly dry.

D. Provide adequate equipment to achieve consistent and uniform compaction of the Planting Soils. Use the smallest equipment that can reasonably perform the task of spreading and compaction.

E. Do not pass motorized equipment over previously installed and compacted soil except as authorized below.

1. Light weight equipment such as trenching machines or motorized wheel barrows is permitted to pass over finished soil work.

2. If work after the installation and compaction of soil compacts the soil to levels greater than the above requirements, follow the requirements of the paragraph "Over Compaction Reduction" below.

F. Following the installation of each soil and prior to fine grading, apply chemical additives as recommended by the soil test, and appropriate to the soil and specific plants to be installed.

3.7 OVER COMPACTION REDUCTION

A. Any soil that becomes compacted to a density greater than the specified density shall be dug up and reinstalled. This requirement includes compaction caused by other sub-contractors after the Planting Soil is installed and approved.

B. Surface roto tilling shall not be considered adequate to reduce over compaction at levels 6 inches or greater below finished grade.

3.8 FINISH GRADING

A. Grade the finish surface of all planted areas to meet the grades shown on the drawings, allowing the finished grades to remain higher than the grades on the grading plan, as defined in paragraph Planting Soil Installation, to anticipate settlement over the first year.

B. Utilize hand equipment, small garden tractors with rakes, or small garden tractors with buckets with teeth for fine grading to keep surface rough without further compaction. Do not use the flat bottom of a loader bucket to fine grade, as it will cause the finished grade to become overly smooth and or slightly compressed.

C. Provide for positive drainage from all areas toward the existing inlets, drainage structures and or the edges of planting beds. Adjust grades as directed to reflect actual constructed field conditions of paving, wall and inlet elevations. Notify the Owner's Representative in the event that conditions make it impossible to achieve positive drainage.

D. Provide smooth, rounded transitions between slopes of different gradients and direction. Modify the grade so that the finish grade before adding mulch and after settlement is one or two inches below all paving surfaces or as directed by the drawings.

E. Fill all dips and remove any bumps in the overall plane of the slope. The tolerance for dips and bumps in shrub and ground cover planting areas shall be a 2 inch deviation from the plane in 10 feet. The tolerance for dips and bumps in lawn areas shall be a 1 inch deviation from the plane in 10 feet.

3.9 CLEANUP AND PROTECTION

A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.

B. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site. The Owner's Representative seals are to remain on the trees and removed at the end of the warranty period.

C. The Contractor shall protect installed and/or modified Planting Soil from damage including contamination and over compaction due to other soil installation, planting operations, and operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Utilize fencing and matting as required or directed to protect the finished soil work. Treat, repair or replace damaged Planting Soil immediately.

D. Make all repairs to grades, ruts, and damage to the work or other work at the site.

3.10 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION

SECTION 32 9200

TURF AND GRASS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide all labor, materials, equipment, services, and perform all operations necessary to complete the work of this section as indicated within the drawings and specified herein which shall include, but is not limited to, the following:

1. Fine grading.

2. Fertilizers and additives as necessary.

3. Seeding.

4. Erosion Control Matting.

5. Maintenance including watering.

B. Contractor is responsible for all health and safety.

1.2 QUALITY ASSURANCE

A. The Contractor must be a member in good standing of the Associated Landscape Contractors of America.

B. The Contractor must show previous evidence of having successfully installed and maintained landscape projects of similar scope to the subject project with regard to quantities of seeding involved, complexity and a minimum of five (5) years experience on projects similar to this one. The Owner's Representative shall have the right to review the qualifications and references of the Contractor for approval to work on this project.

C. Source Quality Control:

1. Analysis and standards: Package standard products with manufacturers certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

D. Within 30 days after award of Contract and before any seeding materials are delivered to the job site, submit to the Owner a complete list of all seeding and other items proposed to be installed. At least 10 days prior to shipment delivery of materials, the Contractor shall submit to the Owner a one (1) cubic foot representative sample, certifications, certified test results for materials as specified below. The Contractor shall provide a listing of the addresses (locations) identifying the origin of the soil to be delivered. If the origin is from multiple locations, test results must be provided for each source as well as the blended final product and all locations shall be provided at the time of submission of required information specified above. No material shall be ordered or delivered until the required submittals have been submitted and approved by the Owner. Delivered materials shall closely match the approved samples. Approval shall not

constitute final acceptance. The Owner reserves the right to reject, on or after delivery, any material that does not meet these specifications.

1.3 RELATED SECTIONS

A. Section 31 2313—SUBGRADE PREPARATION

B. Section 32 9100 – PLANTING SOIL

1.4 SUBMITTALS

A. Submit the following under provisions of Section 01 3300—SUBMITTAL PROCEDURES:

1. Provide watering and fertilizing schedule to Landscape Architect for approval.

2. Provide two marked up prints to the Landscape Architect indicating square footages for all lawn areas with quantities of all soil additives and sod for each area prior to beginning work.

1.5 PROJECT CONDITIONS

A. All areas to be seeded shall be inspected by the Contractor before starting work and any defects, such as incorrect grading, etc., shall be reported to the Landscape Architect prior to beginning this work. The commencement of work by the Contractor shall indicate his acceptance of the areas to be seeded, and he shall assume full responsibility for the work of this Section.

1.6 REFERENCES

A. The work shall conform to the codes and standards of the following agencies, publications as further cited herein:

B. AAN: American Association of Nurserymen, Inc., “Standards for Nursery Stock” ANSI Z60.1—1980, or current edition.

C. ASTM: ASTM International (ASTM), 1916 Race Street, Philadelphia, Pennsylvania, 19103, USA as Published in “Compilation of ASTM Standards in Building Codes”.

D. BHCU: Bailey Hortorium of Cornell University, 1976, Hortus Third, A Concise Dictionary of Plants Cultivated in the United States and Canada (for nomenclature).

E. NAA: National Arborist Association, 3537 Stratford Road, Wantagh, New York, 11793, USA, as published in “Standards for Pruning Shade Trees...”, 1979, or latest edition (for pruning standards).

F. USDA: United States Department of Agriculture, 1941 Yearbook, “Climate and Man” (for average last frost date at locality).

1.7 QUALITY CONTROL/QUALIFICATIONS

A. Provide affidavits from manufacturers major suppliers where required by these Specifications.

B. Fine grading and installation of sod shall be done under the supervision of a qualified foreman acceptable to the Landscape Architect.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver all items to the site in their original containers with all labels intact and legible at time of Owner's inspection.

B. Immediately remove from the site all seeding materials, which are not true to name, and all materials, which do not comply with the provisions of this Section of these Specifications.

C. Use all means necessary to protect seeding materials before, during, and after installation and to protect the installed work and materials of all other trades.

D. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

PART 2 PRODUCTS

2.1 PLANTING SOIL

A. See Section 32 9100 – Planting Soil

2.2 WATER.

1. Water shall be free from impurities injurious to vegetation.

2.3 SEED

A. Lawn Areas

1. Seed mixture shall be fresh, clean, new crop seed. Grass shall be of the previous year's crop and in no case shall weed seed content exceed 1% by weight. The seed shall be furnished and delivered in the proportion specified below in new, clean, sealed and properly labeled containers. All seed shall comply with State and Federal seed laws. Submit manufacturers Certificate of Compliance. Seed that has become wet, moldy or otherwise damaged will not be acceptable.

2. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

a. Seed Mix

Seed Species	% By Weight
Kentucky Bluegrass	50%
Hard Fescue	25%
Perennial Ryegrass	25%

3. Seed mixture to be applied at the following rate:

   a. Six (6) pounds per 1,000 square feet.

4. Seed shall be mixed by a dealer.

2.4 EROSION CONTROL MATTING

A. All slopes greater than 3:1 shall receive erosion control matting.

B. Jute mesh shall be a uniform, open, plain weave cloth of undyed and unbleached single jute yarn. The yarn shall be of a loosely twisted construction and it shall not vary in thickness more than one-half its normal diameter. Jute mesh shall be furnished in rolled strips and shall meet the following requirements:

   Width—48 inches, plus or minus one inch
   78 warp—ends per width of cloth (minimum)
   41 weft—ends per yard (minimum)
   Weight shall average 1.22 pounds per linear yard with a tolerance of plus or minus 5%.

C. Staples shall be U-shaped and shall be approximately six inches long and one inch wide. Machine made staples shall be of No. 11 gauge or heavier steel wire. Handmade staples shall be made from 12-inch lengths of No. 9 gauge or heavier steel wire.

PART 3 EXECUTION

3.1 PREPARATION OF PLANTING SOIL

A. See Section 32 9100 – Planting Soil for soil and soil installation requirements.

B. Immediately before seeding, the ground shall be restored, as necessary, to a loose friable condition by dicing or other approved method to a depth of not less than 2″. The surface shall be cleared of all debris and of all stones 1″ or more in diameter.

C. Weeds and undesirable grasses growing on existing grade that is to be seeded must be cut and removed before soil preparations begins. In some instances, an approved herbicide may be used as directed and approved by the Landscape Architect. Contractor must have current Connecticut certified pesticide applicator perform the work. Signage and pesticide records shall follow applicable regulations.

D. Contractor shall obtain Owner’s Representatives written approval of fine grading and bed preparation before doing any seeding.

3.2 SEEDING

A. All areas indicated on the plan shall be seeded only after written approval of the Owner’s Representative of bed preparation. All disturbed areas outside the limit of seeding shall be seeded.

B. Seeding shall be done only during the period from April 1 to May 30 or August 15 to October 15. The actual planting of seed shall be done, however, only during periods within the season

which are normal for such work as determined by weather conditions and by accepted practice in this locality. At his option, and on his responsibility, the Contractor may plant seed under unseasonable conditions at no increased cost to the Owner.

C. Seeding of lawns shall be done only by experienced workmen under the supervision of a qualified foreman.

D. Seed only when the bed is in a friable condition, not muddy or hard.

E. Seed all areas to be seeded with specified grass seed, sowing evenly with an approved mechanical seeder at the rate of 6 pounds per 1,000 square feet. Sow 3 pounds per 1,000 square feet in one direction and 3 pounds per 1,000 square feet at right angles to the first seeding. Spread seed when soil is moist. Cultipacker, or approved similar equipment, may be used to cover the seed and to firm the seedbed in one operation. In areas inaccessible to cultipacker, the seeded ground shall be lightly raked and rolled in two directions with a water ballast roller. Extreme care shall be taken during seeding and raking to insure that no change shall occur in the finished grades and that the seed is not raked from one spot to another.

F. Hydroseeding is an acceptable manner of seeding, providing the Contractor certifies in writing that the hydro-seed fertilizer mix is as herein specified and applied at the equivalent rate of 6 pounds per 1,000 square feet.

G. If covering and rolling is not properly accomplished by the seeding machine, the seed shall be lightly raked into the ground, after which the ground shall be rolled with a five hundred pound roller and thoroughly and evenly watered with a fine spray to penetrate the soil to a depth of at least two (2) inches.

H. Promptly after seeding, wet the seedbed thoroughly, keeping all areas moist throughout the germination period.

I. Mulch shall be placed immediately after seeding. Straw or salt marsh hay that has been thoroughly fluffed shall be spread evenly and uniformly at the rate of two to three tons per acre. Lumps and thick mulch materials shall be thinned. All mulch anchor stakes, strings and matting shall be removed before final acceptance of lawns. In addition, following mulching, all slopes of 3:1 or greater shall be covered with jute, biodegradable tobacco netting or approved equal. Securely stapled in place. Overlap all joints in netting a minimum of 6″.

J. Hydroseed mix: All work shall be installed using an approved spraying machine specifically used for this purpose. Amounts of fertilizer used shall be as the testing agency recommendations prescribe and as directed by the Owner's Representative. The Contractor shall submit to the Owner's Representative for approval prior to the start of any seeding work, a certified statement as to the number of pounds and types of fertilizer, amounts and types of grass seed and processed fiber per one hundred (100) gallons of water.

1. Hydromulch shall be Terra-Sorb GB or approved equal

    a. Add Terra-Sorb to the hydroseed tank at the rate of sixty (60) pounds per acre.

3.3 EROSION CONTROL MATTING

A. Jute mesh shall be placed within 48 hours after finish grading or topsoiling of an area is completed. If seeding is specified, within 24 hours after seeding of an area is completed. The

jute mesh shall be placed in a manner that will minimize disturbance of the underlying soil. All equipment and application processes shall be approved by the Landscape Architect prior to use.

B. The surface shall be smoothed and all gullies and potholes backfilled prior to applying jute mesh. All rocks or clods larger than two inches in size and all sticks and other foreign material that will prevent contact of the jute mesh with the surface shall be removed. If the surface is extremely dry, the Engineer may require watering prior to placement.

C. Jute mesh shall be placed uniformly, in contact with the underlying soil, at the locations shown on the Drawings or directed by the Landscape Architect. The top edge of each strip shall be anchored by placing a tight fold of mesh vertically in a six inch deep slot or trench in the soil and tamping and stapling in place. Edges of adjacent strips shall be lapped six inches with a row of staples at a maximum interval of three feet in the lapped area. Bottom edges shall be lapped 12 inches over the next lower strip, if applicable, or buried as specified for top edges.

D. Check slots shall consist of separate four foot strips of jute mesh placed at right angles to the direction of water flow immediately prior to placing the general covering of jute mesh. Check slots shall be anchored by burying the top edge of the strip as described above.

E. Check slots shall be spaced so that one check slot, or junction slot of the jute mesh occurs every 75 feet on gradients of less than 4% and every 50 feet on gradients of more than four percent. On slope drains, a check slot or an end slot shall occur every 25 feet unless otherwise specified.

F. Edges of jute mesh shall be buried around the edges of catch basins and other structures.

G. Jute mesh shall be held in place by wire staples driven vertically into the soil. The mesh shall be fastened at intervals not more than three feet apart in three rows for each strip of mesh, with one row along each edge and one row alternately spaced in the middle. All ends of the mesh and check slots shall be fastened at six inch intervals across their width.

H. The Contractor shall maintain the areas covered by jute mesh until final acceptance of the project. Prior to final acceptance, any damaged areas shall be reshaped as necessary, reseeded, if applicable; and the jute mesh satisfactorily repaired or replaced.

3.4 MAINTENANCE FOR SEEDED AREAS

A. Maintenance of grass areas shall consist of watering, mowing, weeding, re-seeding as necessary to obtain an approved stand of grass.

B. Maintenance shall begin immediately after any area is seeded and shall continue until final acceptance, but in no case, less than the following period.

1. Sixty (60) days after substantial completion of seeding.

a. Maintenance may continue until the next growing season if in the opinion of the Owner’s Representative the season enters a winter dormancy and no maintenance should continue.

b. Seeded lawns shall be maintained until all areas have a close stand of grass which has received a minimum of three mowings, has no bare spots greater than two inches in diameter, and at least 90% of the grass established shall be permanent grass species.

c. If stand provides between 40% and 90% ground coverage, overseed and fertilize using half of the rates originally applied. If stand provides less than 40% coverage, reestablish stand following original rates and procedures.

d. Flooded, washed-out, rilled or otherwise damaged or defective areas of seeding, mulch, grade, swales or berms shall be reconstructed and all grades re-established in accordance with the grading plans or other specifications or when, in the judgment of the Owner or Landscape Architect, such defects or damages are the result of poor workmanship, or failure to meet the requirements of the specifications.

C. Maintenance shall include reseeding, mowing, watering, weeding and fertilizing.

D. Watering of Seeded Areas:

1. First Week: The Contractor shall provide all labor and arrange for all watering necessary to establish an acceptable lawn. In the absence of an adequate rainfall, watering shall be performed daily or as often as necessary during the first week and in sufficient quantities to maintain moist soil to a depth of at least two inches.

2. Second and Subsequent Weeks: Water seeded areas as necessary to supplement natural rain to the equivalent of one (1) inch rainfall per week The Contractor shall water the lawn as required to maintain adequate moisture, in the upper two inches of soil, necessary for the promotion of deep root growth.

3. Watering shall be done in a manner, which will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment. The Contractor shall furnish sufficient watering equipment to apply one complete coverage to the seeded areas in an eight (8) hour period.

E. Protection:

1. Seeded areas shall be protected by stakes and caution tape or snowfence as directed by the Landscape Architect. Wire shall not be used.

2. Barriers must be raised immediately after seeding and shall be maintained until acceptance.

F. Reseeding: After the grass in seeded areas has appeared, all areas and parts of areas which, in the opinion of the Owner's Representative, fail to show a uniform stand of grass, for any reason whatsoever, shall be reseeded and such areas and parts of areas shall be seeded repeatedly until all areas are covered with a satisfactory growth of grass. Reseeding together with necessary grading, fertilizing, and trimming shall be done at the expense of the Contractor.

G. Mowing:

1. At the time of the first cutting, there shall be a uniform stand between 3″ and 3½″ high, and mower blades shall be set between 2½″ and 3″ high.

2. Mowing shall include removal of clippings.

H. Fertilizing: A second application of fertilizer, as specified herein, shall be applied after one (1) season of growth of a minimum of two (2) months duration, but only during the months of April,

May, August or September. Fertilizer shall be applied at the rate of thirty (30) pounds per one thousand (1,000) square feet.

I. Liming: If more than one initial application of limestone is required by the soils analysis to bring the pH of the stockpiled topsoil/loam borrow to a specified range, the Contractor shall be responsible for all additional required lime applications.

3.5 CLEANUP AND PROTECTION

A. During seeding work, keep pavements clean and work area in an orderly condition.

B. Protect seeding work and materials from damage due to landscape operations, operations by other Contractors or trades, and trespassers.

1. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.6 ACCEPTANCE

A. The Owner shall inspect all work for Acceptance upon written request of the Contractor. The request shall be received at least 10 calendar days before the anticipated date of inspection. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Owner, he shall certify in writing to the Contractor as to the Acceptance of the work.

3.7 ACCEPTANCE IN PART

A. The work may be accepted in parts when it is deemed to be in the Owner's best interest to do so and when approval is given to the Contractor in writing to complete the work in parts. Acceptance and use of such areas by the Owner shall not waive any other provisions of this Contract.

3.8 CLEANUP

A. When any of this work is done while buildings are occupied, pavements shall be kept clear at all times, broom cleaned to prevent tracking dirt into buildings.

B. After completion of all planting operations, dispose of all debris and excess material to the satisfaction of the Owner. All pavements shall be swept and hosed clean.

3.9 FINAL INSPECTION AND ACCEPTANCE

A. At the end of the guarantee period, the Owner will inspect all guaranteed work for the Final Acceptance upon written request of the Contractor. The request shall be received at least 10 calendar days before the anticipated date for final inspection.

B. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Owner at that time, he shall certify in writing to the Contractor as to the Final Acceptance of the project.

END OF SECTION

DIVISION 33
UTILITIES

SECTION 33 4000

STORM DRAINAGE SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Installation of new storm drain pipe, manholes and catch basins.

2. Relocation and/or replacement of existing storm drain pipe and catch basins.

3. Installation of under-drains.

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

D. Contractor is solely responsible for obtaining permits or approvals which may be required to perform the work of this section, including all costs, fees and taxes required or levied. Notify and obtain such permits or approvals from all agencies having jurisdiction prior to starting work.

1.2 REFERENCE STANDARDS

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

B. Code of Federal Regulations (CFR)

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. ASTM International (ASTM)

1. ASTM A36—Standard Specification for Carbon Structural Steel.

2. ASTM A48—Standard Specification for Gray Iron Castings.

3. ASTM A123—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

4. ASTM A307—Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

5. ASTM A536—Standard Specification for Ductile Iron Castings.

6. ASTM A615—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

7. ASTM C12—Standard Practice for Installing Vitrified Clay Pipe Lines.

8. ASTM C14—Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.

9. ASTM C55—Standard Specification for Concrete Building Brick.
10. ASTM C76—Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
11. ASTM C94—Standard Specification for Ready-Mixed Concrete.
12. ASTM C139—Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
13. ASTM C150—Standard Specification for Portland Cement.
14. ASTM C207—Standard Specification for Hydrated Lime for Masonry Purposes.
15. ASTM C270—Standard Specification for Mortar for Unit Masonry.
16. ASTM C387—Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
17. ASTM C425—Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
18. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
19. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
20. ASTM C478—Standard Specification for Precast Reinforced Concrete Manhole Sections.
21. ASTM F493—Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
22. ASTM C507—Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
23. ASTM C564—Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
24. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
25. ASTM C700—Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
26. ASTM C877—Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections.
27. ASTM C890—Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
28. ASTM C913—Standard Specification for Precast Concrete Water and Wastewater Structures.

29. ASTM C923—Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

30. ASTM C990—Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.

31. ASTM C1479—Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations

32. ASTM C 1628—Standard Specification for Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets.

33. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

34. ASTM D1785—Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120.

35. ASTM D2235—Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

36. ASTM D2241—Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

37. ASTM D2321—Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

38. ASTM D2412—Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

39. ASTM D2466—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

40. ASTM D2467—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

41. ASTM D2564—Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

42. ASTM D2855—Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

43. ASTM D2665—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

44. ASTM D2729—Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

45. ASTM D2855—Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

46. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

47. ASTM D3350—Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

48. ASTM D4396—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Nonpressure Applications.

49. ASTM F402—Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.

50. ASTM F405—Corrugated Polyethylene (PE) Tubing and Fittings.

51. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

52. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

53. ASTM F679—Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

54. ASTM F714—Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

55. ASTM F758—Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage.

56. ASTM F894—Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.

57. ASTM F1803—Standard Specification for Poly (Vinyl Chloride)(PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter.

58. ASTM F2306—Standard Specification for 12 to 60 inch [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.

59. ASTM F2648—Standard Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.

D. American Concrete Pipe Association (ACPA).

1. ACPA 01-103—Concrete Pipe and Box Culvert Installation (latest revision and applicable supplements thereto).

E. American Association of State High and Transportation Officials (AASHTO).

1. AASHTO H20—Standard Specifications for HS-20, Highway Loading.

2. AASHTO M105—Standard Specification for Gray Iron Castings.

3. AASHTO M198—Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.

4. AASHTO M252—Standard Specification for Corrugated Polyethylene Drainage Pipe.

5. AASHTO M294—Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm Diameter.

F. Corrugated Polyethylene Pipe Association (CPPA), division of the Plastics Pipe Institute (PPI).

1. Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings (latest revision and applicable supplements thereto).

G. State of Connecticut Department of Transportation (ConnDOT)

1. Standard Specifications for Roads, Bridges, Facilities, and Incidental Construction, Form 817, 2016 and any supplements.

1.3 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings, descriptive literature, or both, showing pipe materials and appurtenances to be furnished. Shop drawings shall be submitted to Engineer for approval prior to ordering materials.

2. Shop drawings showing the configuration, dimensions, layout, and spacing of major and minor components such as pipe, joints, couplings, restraints, and other proposed details of assembly. Show in large-scale details any unique assembly, pipe/pipe transitions, pipe/structure transitions, and/or installation requirements.

B. Copies of manufacturer-provided installation instructions, operation instructions, and maintenance material for all equipment furnished under this Section.

C. Manufacturer's warranties and associated warranty registration data in Owner's name. Submit two (2) copies of each warranty to Engineer in the manufacture/supplier standard form or if there is no standard form available, in a form specified by Engineer.

D. As-Built Drawings.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section. Use equipment of adequate size, capacity and quantity to accomplish the work of this Section in a timely manner.

B. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

C. Sample pipe for testing, when requested by Engineer, shall be furnished by Contractor in sufficient numbers. The Contractor and/or the pipe manufacturer shall make the facilities and services for making the load tests available.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage

1. Manufacturer shall package the pipe and other drainage materials in a manner designed to deliver the pipe to the Project Site neatly, intact, and without physical damage. Transportation carrier shall use an appropriate method to ensure the pipe is properly supported, stacked, and restrained during transport. Inspect materials delivered to site for damage; store with minimum of handling.

2. Unloading of the pipe and other drainage materials should be controlled so as not to collide with the other pipe sections or fittings, and care should be taken to avoid chipping or spalling, especially to the spigots and bells. For manhole sections, cone sections, bases, fittings and other precast appurtenances, utilize lifting holes or lifting eyes provided.

3. In cold weather conditions, use caution to prevent impact damage. Handling methods considered acceptable for warm weather may be unacceptable during cold weather.

4. Storage:

    a. Store materials on site in enclosures or under protective coverings. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

    b. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging.

    c. Store solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials under cover out of direct sunlight. Provide additional storage measures in accordance with the manufacturer's recommendations. Discard materials if storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

    d. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

    e. Cement, Aggregate, and Reinforcement: As specified in Section 033200—Site Cast-in-Place Concrete.

    f. Store manhole units in an upright position.

PART 2 MATERIALS

2.1 GENERAL

A. Products furnished under this Section which are damaged or found defective in any way prior to being set in place and final acceptance, may be rejected. Engineer may reject an entire lot of pipe should the sample pipe from such lot fail to meet requirements.

2.2 CONCRETE GRAVITY PIPE

A. Reinforced concrete pipe:

1. Pipe less than 12 inches in diameter: ASTM C14, Class 3.

2. Pipe greater than 12 inches in diameter: ASTM C76, Class 3.

3. Class 4 pipe shall be required when cover is less than 12 inches.

B. Fittings and specials: conform to the applicable requirements specified for the pipe.

C. Gaskets and pipe ends for rubber gasket joint: ASTM C443.

2.3 CORRUGATED POLYETHYLENE PIPE

A. Pipe: High density polyethylene, corrugated, smooth interior, ASTM D3350, Cell Classification 424420C.

1. Four (4) inch through 10 inch diameter pipe: AASHTO M252, Type S.

2. 12 inch through 60 inch diameter pipe: AASHTO M294, Type S or ASTM F2306.

B. Joints: Bell-and-spigot joint, AASHTO M252, AASHTO M294, or ASTM F2306. Bell shall be an integral part of the pipe and provide a minimum pull-apart strength of 400 pounds. Bell-and-spigot joint shall incorporate a gasket making it silt-tight. Gaskets shall be installed in the bell, or on the pipe by the pipe manufacturer.

1. Four-inch (4″) through 60-inch (60″) diameter pipe joint, watertight, ASTM D3212. Gaskets: polyisoprene, ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

2. 12-inch (12″) through 60-inch (60″) diameter pipe shall have a reinforced bell with a bell tolerance device. The bell tolerance device shall be installed by the manufacturer.

3. Coupling bands shall conform to the manufacturer's specifications. Couplers shall cover not less than one corrugation on each section of pipe.

C. Fittings: AASHTO M252, AASHTO M294, or ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of AASHTO M252, AASHTO M294 or ASTM F2306.

D. Saddle Tee

1. Saddle tees shall be manufactured saddle tees designed to connect to the corrugated polyethylene pipe.

2. Fittings shall conform to AASHTO M 294. Fabricated fittings shall be welded on the interior and exterior of all junctions.

3. A soil-tight seal shall be obtained with the coupling at the saddle tee stub to the storm service pipe.

2.4 UNDERDRAIN

A. Corrugated Polyethylene Pipe: AASHTO M252

B. Pipe 4-inches and smaller: single wall, high density corrugated polyethylene with annular interior and exterior corrugations, AASHTO M252, Type CP (Single wall, corrugated, perforated).

C. Pipe greater than 4-inches: Type SP (Double Wall, Perforated), AASHTO M252 (up to 10-inches or AASHTO M294 (greater than 12-inches).

1. Perforations: Class 2 slotted perforations per AASHTO M252. Perforations shall be uniformly spaced along the length and circumference of the pipe.

D. Joints: Joints shall be made with split or snap couplings. Standard connection shall meet the soil-tightness requirements of AASHTO M252 or M294. Gasketed connections shall incorporate a closed-cell synthetic expanded rubber gasket meeting the requirements of ASTM D1056 Grade 2A2. Gaskets, when applicable, shall be installed by the pipe manufacturer.

2.5 JOINT LUBRICANT

A. As specified by pipe manufacturer, ANSI/AWWA C111/A21.11.

2.6 CATCH BASINS

A. Reinforced precast concrete base, sump, transition, riser, corbel, and top: ASTM C913 for precast rectangular catch basins, ASTM C478 for precast circular catch basins. Type, construction, and dimensions as indicated on the Drawings.

1. Concrete: 4,000 psi minimum, 4%–7% entrained air.

2. Reinforcement: ASTM C890. Steel bars, ASTM A615. Welded-wire fabric, ASTM A185. Additional reinforcing at openings.

3. Precast sections shall consist of smooth sections in standard nominal inside diameters. All precast concrete sections shall be free from cracks, damaged joints, exposed reinforcing, aggregate pockets, spalls, and dimensional distortions or other irregularities. Lifting holes shall be filled with mortar, or other approved material.

4. Openings or “knockouts” in precast units shall be located as shown on the Drawings and to accommodate the inflow and outflow pipe orientation required. Openings shall be sized sufficiently to permit passage of the largest outside dimension of pipe or fittings. Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.

5. [External damp-proofing: Asphalt, ASTM D449, Type A.]

B. Gaskets for joints between sections: Butyl rubber, ASTM C443.

C. Grade Rings: ASTM C478, precast reinforced concrete, 1-inch to 4-inch thickness, dimensions to match basin and top section.

D. [Catch basin trap]

1. [Cast Iron] [Polyethylene] [Neenah Model R-3701, LeBaron Oil and Grease Trap Model L-219, Neenah Model R-3707, or approved equivalent.] Type and dimensions as indicated on the Drawings.

E. [Catch basin hood]

1. [Cast Iron] [Polyethylene] Type and dimensions as indicated on the Drawings.

F. Frame and Grate.

1. Cast iron: AASHTO M 105, Class 25 for frames and Class 30 for grates.

2. Cast steel: ASTM A27, Grade optional, thoroughly annealed.

3. Structural Steel: ASTM A36, or A283, Grade B or better, as to quality and details of fabrication, except that in the chemical composition of the steel, the 2/10 of 1% of copper may be omitted.

4. Grate type: ConnDOT "Type A" unless otherwise specified.

5. Covers and gratings shall bear uniformly on their supports.

6. Frame and grate shall be painted, ConnDOT Form 817 M.06.03. Cast Iron frames and grates shall not be galvanized.

2.7 YARD DRAIN/AREA DRAIN

A. Configured as indicated on the Drawings. Pre-formed PVC unit with integral inlets/outlets or PVC pipe stock assembled to provide a complete unit. Provide pipe adaptors as required to connect to drainage piping of the type specified.

B. Frame and Grate: Ductile iron as an integral part of the surface drainage inlet and furnished by the same manufacturer of the drain, frame and grate set manufactured for use on PVC pipe, or insert-type grate manufactured for use on PVC pipe.

1. Grates for drain basins shall be capable of supporting H-20 wheel loading for traffic areas or H-10 loading for pedestrian areas.

2. 12″ and 15″ square grates will be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron.

3. Grates shall be provided painted black.

2.8 CONCRETE MANHOLE

A. Precast concrete manhole risers, base sections, and tops: ASTM C478. Precast manhole sections shall consist of smooth circular sections in standard nominal inside diameters. All precast concrete manhole sections shall be free from cracks, damaged joints, exposed reinforcing, aggregate pockets, spalls, and dimensional distortions or other irregularities. Lifting holes, when provided, shall be filled with mortar, or other approved material.

1. Concrete: 4,000 psi minimum, 4%–7% entrained air.

2. Diameter: 48 inches unless otherwise indicated.

3. Base and first riser: Monolithic and built to the dimensions and requirements indicated on the Drawings.

a. Bottoms shall be integrally cast unless specialty bases at points of connection to existing piping ("Dog-House") is indicated on the Drawings or otherwise proposed for use. Unless indicated on the Drawings, any special bases or riser used must be detailed in shop drawings and submitted for approval.

4. Riser sections: As required to provide depths indicated.

5. Top Section: Concentric-cone type, unless eccentric-cone or flat-slab-top type is indicated. Cones shall have the same wall thickness and reinforcement as riser sections. If required or called-for, flat slab shall be a minimum of 8 inches thick designed to carry AASHTO H-20 loading with one foot cover and conform to ASTM C478.

6. External damp-proofing: Asphalt, ASTM D449, Type A.

7. [Internal waterproofing: Where required, 60-mil polyvinylchloride or polyethelene sheet with webs or ribs to mechanically lock the sheet to the manhole wall. Joint strips shall be ribless and shall be a minimum of 4 inches wide.]

8. Openings or "knockouts" in precast units shall be located as shown on the Drawings and to accommodate the inflow and outflow pipe orientation required. Openings shall be sized sufficiently to permit passage of the largest outside dimension of pipe or fittings. Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.

B. Gaskets for joints between manhole sections: Butyl rubber, ASTM C443.

C. Grade Rings: ASTM C478, precast reinforced concrete, 1 inch to 4 inch thickness, diameter to match manhole and frame.

D. Mortar: Packaged, ASTM C387 or as Specified in Section 033200—Site Cast-in-Place Concrete.

E. [Frame and Cover: Ductile Cast Iron, ASTM A536, Grade 60-40-18.]

F. [Frame and Cover: Grey Cast Iron, ASTM A48, Class 25B (Frame) and Class 30B (Covers), uncoated.]

1. Cover: 26 inch diameter, non-vented with non-penetrating pickholes. Unless otherwise detailed or indicated, covers shall be cast with 1½ inch wide, raised letters, indicating "STORM SEWER" unless other lettering is called-for.

2. Frame and cover shall be supplied as a pair from the same manufacturer. Castings shall be of tough, even-grained iron, free from scale, lumps, blisters, sand-holes and other injurious defects, and of the size and type shown on the Drawings. Frames and covers shall have machined bearing surfaces to seat firmly and prevent rocking and rattling under traffic loads. Before leaving the foundry, castings shall be thoroughly cleaned, subjected to hammer tests for soundness and given two coats of coal tar pitch varnish.

G. Resilient connectors for joints between manhole and pipes entering manhole: Continuous boot of ⅜ inch minimum thickness neoprene, ASTM C923 or ASTM C990. Boots shall be either cast into the manhole wall or installed into a cored opening using internal compression rings. Installed boot shall result in a water-tight connection meeting the performance requirements of ASTM C443.

H. Manhole Steps: ASTM C478 and OSHA 29 CFR 1910.27, drop front or equivalent. Steps shall be nine inches in depth and at least twelve inches in width with an abrasive step surface.

1. [Cast Aluminum Alloy: Aluminum alloy, 6061-T6, tensile 38,000 psi, yield 35,000 psi. Drop front design with upturned embedded ends. All parts of aluminum steps to be

embedded in concrete or masonry shall be coated with bituminous paint or zinc chromate primer.]

2. [Composite Plastic-Steel: One-half (½) inch deformed steel reinforcing rod, ASTM A615, Grade 60, encapsulated in a co-polymer polypropylene plastic, ASTM D2146, Type II, Grade 16906.]

3. Steps shall be placed in vertical alignment as indicated on the Drawings. Steps shall be uniformly spaced not more than sixteen inches (16″) on center, including the spacing between the top step and the manhole cover. Steps shall be embedded in the wall a minimum distance of 4 inches in either cast or drilled holes. Steps shall not be driven or vibrated into fresh concrete and shall withstand a pullout resistance of 2000 lbs when tested in accordance with ASTM C497. Each step shall project a minimum of 5 inches from the wall measured from the point of embedment.

2.9 DROP MANHOLE

A. Drop inlet shall be constructed with ductile iron gravity pipe laid in undisturbed soil in conformance with ASTM A746-82. Adapt to PVC with Fernco coupling or approved equivalent.

B. Vertical drop pipe shall be 8″, 10″, or 12″ maximum SDR 35 PVC with 90 degree short bend radius shall conform to ASTM D3034.

C. Vertical drop pipe shall be anchored a minimum of every 4 feet with ⅛″ x 1½″ type 304 stainless steel pipe straps set as ordered with lag bolts and shields.

2.10 MASONRY UNITS

A. Brick: ASTM C32 Grade MS or ASTM C62 Grade SW.

B. Concrete block: Solid block, ASTM C139.

2.11 MORTAR

A. Mortar: ASTM C387.

1. Portland Cement: ASTM C150, Type I.

2. Sand: ASTM C144.

3. Hydrated Lime: ASTM C207.

4. Water: Potable.

5. Mix proportions for manhole rims and covers: 1 part portland cement, 2 parts sand, and ¼ part hydrated lime by dry volume. Hydrated lime shall not exceed 10 percent by weight of the total dry mix. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed 5½ gallons of water per sack of cement.

6. Mix Proportions for invert construction: 1 part portland cement and 2 parts sand by volume. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed 5½ gallons of water per sack of cement.

2.12 BEDDING

A. Bedding for concrete and PVC pipes: Bedding, Haunching and Initial Backfill shall consist of screened gravel, maximum size ¾ inches and minimum size ⅜ inches.

B. Bedding for HDPE pipes: Bedding, Haunching and Initial Backfill shall consist of ConnDOT No. 6, No. 67, or No. 8 aggregate, or other materials meeting the requirements of ASTM D2321 for Class IA, Class IB, Class II, or Class III unless otherwise specified by the pipe manufacturer.

C. Bedding for Catch Basins: Screened Gravel or Crushed Stone, well graded in size from ¾ inch to ⅜ inch consisting of clean, hard, and durable fragments. No limestone shall be permitted.

PART 3 EXECUTION

3.1 PIPE INSTALLATION

A. As soon as the excavation is completed to the normal grade of the bottom of the trench, the Contractor shall immediately place the bedding material in the trench. Then the pipe shall be firmly bedded in the compacted bedding material to conform accurately to the lines and grade indicated on the Drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions.

1. Concrete pipe shall be installed per ASTM C1479, as may be modified by the pipe manufacturer's instructions.

2. HDPE pipe shall be installed per ASTM D2321, as may be modified by the pipe manufacturer's instructions.

C. Notch under pipe bells and joints, where applicable to provide for uniform bearing under entire length of pipe.

D. Excavation, backfilling and compaction shall be as specified in Section 312310—Earthwork of these Specifications.

E. Maintain optimum moisture content of bedding material to attain required compaction density.

3.2 MANHOLES AND CATCH BASINS

A. Manholes and Catch Basins shall be constructed at the locations and to the lines, grades and dimensions noted on the Drawings, or as required.

B. Precast concrete construction shall be done in a manner to insure watertight construction and all leaks in precast concrete shall be sealed. If required, precast concrete shall be repaired or replaced to obtain watertight construction.

C. Concrete barrels and cones shall be precast concrete sections.

1. Bases shall be either precast with a barrel integrally cast with the base, or poured concrete suitably shaped by means of accurate bell-rung forms to receive the barrel sections. Manhole invert channels in manholes shall be formed in concrete.

2. Precast manholes shall have an adjustment ring at the top of the cone to permit the frame and cover to meet the finished surface. This shall consist of courses of brick or reinforced grading rings not to exceed 11 inches.

D. Stubs shall be short pieces cut from the bell ends of the appropriate size and class of pipe. Concrete stubs shall be plugged with brick masonry unless otherwise directed.

E. Manhole inverts shall conform accurately to the size of the adjoining pipes.

1. Manhole inverts shall be constructed of concrete developing 3,500 psi with the concrete being placed to the spring line of the pipe form.

2. Smooth plastic pipe, matching the dimension of the outlet pipe, shall be used to form the invert.

3. Side inverts and main inverts, where the direction changes, shall be laid out in smooth curves of the longest possible radius, which is tangent, within the manhole, to the centerline of adjoining pipelines.

4. Invert shelves shall be graded to provide a 1-inch per 1-foot wash from the manhole walls.

F. Manhole sections shall contain manhole steps accurately positioned and embedded in the concrete when the section is cast. Precast-reinforced concrete manhole sections shall be set so as to be vertical and with sections and steps in true alignment.

G. All holes in sections used for their handling shall be thoroughly plugged with rubber plugs, made specifically for this purpose, or with mortar. The mortar shall be one part cement to 1½ parts sand, mixed slightly damp to the touch (just short of "balling"), hammered into the holes until it is dense and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.

H. The Contractor may, as an alternate to suitable nonshrink mortar joints, use premolded elastomeric-sealed joints for pipe into precast manhole bases.

1. All materials, accessories and construction methods used in making the joints shall be supplied or approved by the manufacturer of the premolded elastomeric-sealed joint.

I. Openings for pipe and materials to be embedded in the walls of the base for these joints shall be cast in the base at the required locations during the manufacturer of the base. Incorrectly cast and patched pipe openings will be rejected.

J. Manhole risers and tops shall be installed using approved "o-ring" type, neoprene gaskets for sealing joints. Units shall be installed level and plumb. Water shall not be permitted to rise over newly made joints nor until after inspection as to their acceptability. All jointing shall be done in a manner to insure water tightness.

K. Openings shall be provided in the risers to receive entering pipes. These openings may be made at the place of manufacture. The openings shall be sized to provide a uniform 1 inch maximum annular space between the outside of the pipe wall and the opening in the riser. After the pipe is in position, the annular space shall be solidly filled with nonshrink mortar. Care shall be taken to assure that the openings are located to permit setting of the entering pipe at its correct elevation as indicated.

L. Openings, which are cut in the risers in the field, shall be carefully made by coring so as not to damage the riser. Damaged risers will be rejected and shall be replaced at no additional expense to the Owner.

M. Where required by the Drawings, a slot and opening shall be cast in the catch basin wall suitable for mounting the cast iron hood and discharge pipe. The hood hinge may be furnished to the precast supplier by the Contractor for incorporation into the casting during manufacture.

3.3 BRICK MASONRY

A. Brick Masonry Construction shall be done in a manner to insure watertight construction and all leaks in brick masonry shall be sealed. All workmanship shall conform to the best standard practice and all brick masonry shall be laid by skilled workmen.

B. All beds on which masonry is to be laid shall be cleaned and wetted properly. Brick shall be wetted as required and shall be damp but free of any surface water when placed in the Work. Bed joints shall be formed of a thick layer of mortar, which shall be smoothed or furrowed slightly. Head joints shall be formed by applying to the brick to be laid a full coast of mortar on the entire end, or on the entire side as the case requires, and then shoving the mortar covered end or side of the brick tightly against the bricks laid previously. The practice of buttering at the corners of the brick and then throwing the mortar or crappings in the empty joints will not be permitted. Dry or butt joints will not be permitted. Joints shall be uniform in thickness and shall be approximately 1¼ inch thick.

C. Brickwork shall be constructed accurately to dimensions and brickwork at top of manholes shall be to the dimensions of the flanges of the cast-iron frames.

D. Joints on the inside face of walls shall be tooled slightly concave with an approved jointer when the mortar is thumbprint hard. The mortar shall be compressed with complete contact along the edges to seal the surface of the joints.

E. All castings to be embedded in the brickwork shall be accurately set and built-in as the Work progresses. Cast-iron frames and manhole covers shall be well bedded in mortar and accurately set to finished graded indicated or as directed.

F. Water shall not be allowed to flow against brickwork or to rise on the masonry for 60 hours after it has been laid, and any brick masonry damaged in this manner shall be replaced as directed at no additional expense to the Owner. Adequate precautions shall be taken in freezing weather to protect the masonry from damage by frost.

3.4 CONCRETE MASONRY UNITS

A. Concrete Masonry unit construction shall be soaked in water before laying. As circular concrete block walls are laid-up, the horizontal joints and keyways shall be flushed full with mortar. As rectangular blocks are laid-up, all horizontal and vertical joints shall be flushed full with mortar. Plastering of the outside of block structures will not be required. The joints in precast units shall be wetted and completely mortared immediately prior to setting a section. No structure shall be backfilled until all mortar has completely set.

3.5 MANHOLE STEPS

A. Placement of steps into the precast walls shall be by a proven method as recommended by the supplier of the precast manhole sections. Details of the steps and method of placement shall be submitted for approval.

B. Plastic steps shall be placed into the wet concrete wall during manufacture or if designed for press fit installation shall be driven into a wall opening according to the manufacturer's specifications. Steps shall not be mortared into place after the concrete has set.

C. All manholes, catch basins, lawn inlets, etc., which are in excess of five feet in depth, shall be constructed with standard aluminum steps, spaced at 12-inch on center.

3.6 DROP INLETS

A. Drop inlets shall be constructed to the lines, grades, dimensions and design at the locations indicated on the Drawings or as required.

B. Construction shall conform to requirements outlined in Section 033013—Site Cast-in-Place Concrete.

C. Engineer may permit brick or concrete masonry construction. If this alternate is being employed, construction shall be done in accordance with paragraphs 3.04 or 3.05 in this Section.

3.7 CASTINGS

A. Cast-iron frames for grates and covers shall be well bedded in cement mortar and accurately set to the grades indicated or as directed. The frames shall be encased with a thick cement-mortar collar around the entire perimeter of the frames.

B. All voids between the bottom flange shall be completely filled to make a watertight fit. A ring of mortar, at least one inch thick and pitched to shed water away from the frame shall be placed over and around the outside of the bottom flange. The mortar shall extend to the outer edge of the masonry all around its circumference and shall be finished smooth. No visible leakage will be permitted.

C. Structures within the limits of bituminous concrete pavement shall be temporarily set at the elevation of the bottom of the binder course or as ordered. After the binder course has been compacted, these structures shall be set at their final grade. Backfill necessary around such structures after the binder course has been completed shall be made with Class A concrete unless otherwise ordered.

3.8 STORMWATER TREATMENT UNIT

A. Stormwater Treatment Units shall be installed in accordance with the manufacturer's instructions.

B. Vaults shall be placed on a minimum foundation of 12 inches of gravel material. If groundwater is encountered, the foundation base shall be a minimum of 12 inches of crushed stone.

C. If precast sections are to be field assembled, adequate waterproofing shall be used at the joints.

D. Stormwater Treatment Units installed on interior floor drain discharges from parking garages shall have gasoline trapping capabilities in accordance with local and state regulations.

3.9 CLEANING

A. At the completion of the Work, clean all piping, structures and open drainage courses, through and to which water from this construction is directed, to the satisfaction of Engineer.

3.10 AS-BUILT DRAWINGS

A. Contractor shall be solely responsible for complying with the requirements of local permitting authorities for preparation and submittal of as-built drawings. The requirements for the preparation of as-built drawings as defined herein shall be considered the minimum requirements of Engineer, but shall in no way relive Contractor from satisfying the requirements of local permitting authorities.

B. As work progresses, record the following on two (2) sets of Drawings:

1. All changes and deviations from the design in location, grade, size, material, or other feature as appropriate.

2. Any uncharted locations of utilities or other subsurface feature encountered during installation, including the characteristics of such uncharted utility or subsurface feature such as utility type, size, depth, material of construction, etc.

C. Recording of changes shall be clearly and neatly marked in red pen or pencil. All changes shall be noted on the appropriate Drawing sheets.

D. Make measurements from fixed, permanent points on the Project Site to accurately locate the work completed. Such measurements shall consist of at least three (3) ties showing the distance of each item relative to each of the fixed, permanent points.

E. As-Built drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall also contain any additional information required by Engineer.

END OF SECTION

SECTION 33 4423

TRENCH DRAIN

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF THE WORK

A. The work under this Section shall consist of the furnishing and installation of a pre-sloped and manufactured trench drain system set in a concrete bed.

B. The Contractor shall submit shop drawings prepared by the manufacturer of the trench drain for review by Engineer.

C. Contractor is responsible for all health and safety.

1.3 SUBMITTALS

A. Manufacturers Product Data

1. Provide manufacturers product data prior to actual field installation work, for Engineer's and Owner's representatives review.

2. Material safety data sheets on all products, as necessary.

B. Shop Drawings

1. Contractor shall submit shop drawings showing plan of entire drainage system listing all parts being provided with exact center line dimensions suitable for installation.

1.4 QUALITY ASSURANCE

A. Manufacturers warranties shall pass to the Owner and certification made that the product materials meet all applicable grade trademarks or conform to industry standards and inspection requirements.

1.5 PRODUCT DELIVERY AND STORAGE

A. Materials delivered to the site shall be examined for damage or defects in shipping. Any defects shall be noted and reported to the Owners representative. Replacements, if necessary, shall be immediately re-ordered, so as to minimize any conflict with the construction schedule. Sound materials shall be stored above ground under protective cover or indoors so as to provide proper protection.

PART 2 PRODUCTS

2.1 TRENCH DRAIN

A. Trench drain shall be Klassik Drain model K100, 4" modular trench system as manufactured by ACO Sport, or approved equal.

1. Grates: Trench DrainLok, Load Class A (3,500lbs), Type 410D/412D Galvanized Perforated Steel as supplied by ACO USA or approved equal.

2. Provide all required accessories and components for a complete and functional system.

2.2 SLOT DRAIN

A. Modular trench drainage system manufactured from corrosion resistant polyester polymer concrete including interconnecting modular components.

B. Slot drain shall be System 3000 slot channel trench drain system as manufactured by ACO Sport, or approved equal.

1. Provide all required accessories and components for a complete and functional system.

PART 3 EXECUTION

3.1 CONSTRUCTION METHODS

A. All manufactured trench drain systems shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 33 4616

FIELD SUBDRAINAGE SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Installation of a multi-component field drainage system on top of a prepared subgrade and perimeter collector drains.

2. Testing, monitoring, and reporting.

B. Contractor shall coordinate work between all Contractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for all health and safety.

1.2 REFERENCES

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

B. Code of Federal Regulations (CFR).

1. 29 CFR 1926, Safety and Health Regulations for Construction.

C. State of Connecticut.

1. Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 817, 2016 and any supplements.

D. American Association of State High and Transportation Officials (AASHTO).

1. AASHTO M252—Standard Specification for Corrugated Polyethylene Drainage Pipe

E. ASTM International (ASTM)

1. ASTM C88—Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

2. ASTM C131—Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

3. ASTM D422—Standard Test Method for Particle Analysis of Soils.

4. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3(2,700 kN-m/m3)).

5. ASTM D2434—Standard Test Method for Permeability of Granular Soils (Constant Head).

6. ASTM D2922—Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

7. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

8. ASTM F1551/EN 12616—Standard Test Method for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials

9. ASTM D3786—Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method.

10. ASTM D4355—Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.

11. ASTM D4491—Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

12. ASTM D4533—Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

13. ASTM D4632—Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

14. ASTM D4833—Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

15. ASTM D4751—Standard Test Method for Determining Apparent Opening Size of a Geotextile.

16. ASTM D7001—Standard Specification for Geocomposites for Pavement Edge Drains and Other High-Flow Applications.

F. Fédération Internationale de Football Association (FIFA)

1. EN 13036—Surface Planarity/Surface Regularity

1.3 SUBMITTALS

A. Sampling and Testing Laboratory: Submit name and qualifications of commercial sampling and testing laboratory for Engineer's approval.

B. Testing Agency: Submit name and qualifications of third-party in-field quality control Testing Agency for Engineer's approval.

C. Surveyor: Submit name and qualifications of Professional Land Surveyor who will be responsible for layout and verification of the work of this Section.

D. Product Data: Submit manufacturer's product data demonstrating compliance with this specification. Include manufacturer's written instructions for each product.

1. Flat Panel Drain

2. Geotextile

E. Confirmation of Acceptance, Design: Submit a signed written statement signed by the manufacturer of the synthetic turf materials confirming that:

1. The field subdrainage system design meets the requirements of the synthetic turf surfacing manufacturer and the that if the system is constructed as designed there will be no conflicts with the conditions of the warranty.

F. Material Testing Data: Submit for approval test results for all material testing performed under the Article "Testing, Pre-Construction" herein. Failure to submit testing results shall in no way relive Contractor from his obligation to meet the performance requirements of the field subdrainage system in all regards.

1. Material testing data shall be no older than three (3) months from proposed material placement date. Testing data older than three (3) months will be rejected.

G. Pre-Construction drainage testing: Submit for approval test results for all drainage testing performed under the Article "Testing, Pre-Construction" herein. Failure to submit testing results shall in no way relive Contractor from his obligation to meet the performance requirements of the field subdrainage system in all regards.

H. Samples

1. Submit for approval samples of proposed materials. Failure to submit samples shall in no way relieve Contractor from his obligation to meet the performance requirements of the field subdrainage system in all regards. Submit the following:

a. Flat Panel Drains: Submit 12-inch-long product sample.

b. Field Base, Bottom Stone: Deliver to the Project Site one 5 gallon bucket of material in an air-tight container. Provide sample within 10 days of contract award. Sample shall be accompanied by adequate labelling indicating project name, source of supply, and identified as "Field Base, Bottom Stone".

c. Field Base, Top Stone: Deliver to the Project Site one 5 gallon bucket of material in an air-tight container. Provide sample within 10 days of contract award. Sample shall be accompanied by adequate labelling indicating project name, source of supply, and identified as "Field Base, Top Stone".

d. Collector Pipe Stone, Bottom Stone: Deliver to the Project Site one 5 gallon bucket of material in an air-tight container. Provide sample within 10 days of contract award. Sample shall be accompanied by adequate labelling indicating project name, source of supply, and identified as "Collector Pipe Stone, Bottom Stone".

e. Collector Pipe Stone, Top Stone: Deliver to the Project Site one 5 gallon bucket of material in an air-tight container. Provide sample within 10 days of contract award. Sample shall be accompanied by adequate labelling indicating project name, source of supply, and identified as "Collector Pipe Stone, Top Stone".

I. Material Certificates: Submit certificates for Bottom Stone, Top Stone, and Collector Pipe Stone materials signed by material producer and Contractor, certifying that each material delivered to the project complies with, or exceeds the requirements specified herein.

J. Quality Control Testing Results

1. Submit results of all test results performed under Article 1.6 “Testing, Quality Control During Construction” herein. Provide copies of all Testing Agency reports.

2. Failure to submit quality control testing results shall in no way relive Contractor from his obligation to meet the performance requirements of the field subdrainage system in all regards.

K. Progress Survey: Submit Progress Survey prepared by Professional Land Surveyor for review by Engineer and turf installer.

L. Confirmation of Acceptance, Completed Base: Submit a signed written statement signed by the manufacturer of the synthetic turf surfacing materials and countersigned by the synthetic turf installer (if different), confirming that:

1. Based on the Progress Survey and visual inspections, all applicable areas and surfaces are satisfactory for the installation of the synthetic turf surfacing material.

2. No conditions exist that are in conflict with the synthetic turf material warranty requirements.

1.4 DELIVERY, STORAGE AND HANDLING

A. Drainage Stone

1. Schedule delivery to minimize on-site storage. Segregate differing stone materials and prevent from contamination with other materials.

2. Coordinate procurement of stone with the sampling and in-field testing required herein.

B. Geotextiles

1. Follow geotextile manufacturer’s recommendations for packaging, transportation, and delivery to ensure materials are not damaged. Furnish the geotextile fabric in a wrapping that protects the fabric from ultraviolet radiation and from abrasion due to shipping and hauling.

2. Geotextile shall be stored on a prepared surface (not wooden pallets) and should not be stacked more than two rolls high. Storage shall be such that the geotextile is protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or cold, or other damaging circumstances. Temporary storage at the Project Site shall be away from standing water such that crushing or flattening of roll goods does not occur.

C. Piping and Drains

1. Manufacturer shall package the pipe and other drainage materials in a manner designed to deliver the pipe to the Project Site neatly, intact, and without physical damage. Transportation carrier shall use an appropriate method to ensure the pipe is properly supported, stacked, and restrained during transport. Inspect materials delivered to site for damage; store with minimum of handling.

2. Unloading of the pipe and other drainage materials should be controlled so as not to collide with the other pipe sections or fittings, and care should be taken to avoid chipping or

spalling, especially to the spigots and bells. For manhole sections, cone sections, bases, fittings and other precast appurtenances, utilize lifting holes or lifting eyes provided.

3. In cold weather conditions, use caution to prevent impact damage. Handling methods considered acceptable for warm weather may be unacceptable during cold weather.

4. Storage: Store materials on site in enclosures or under protective coverings. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

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 this Section.

B. Engineer reserves the right to perform all in-field testing specified in this Section and reserves the right to determine the suitability of all materials to be used for in the work, and to reject any material not meeting these specifications.

C. Sampling and Testing Laboratory: The Sampling and Testing Laboratory shall be a qualified commercial entity with a documented track record of conducting sampling and laboratory testing in support of construction projects. Once approved, the Sampling and Testing Laboratory shall not be changed without Engineer's approval.

D. Testing Agency: The Testing Agency shall be a qualified commercial entity with a documented track record of performing in-field testing and inspection services. The Sampling and Testing Laboratory may provide the services of the Testing Agency provided it meets the qualifications to do so. Once approved, the Testing Agency shall not be changed without Engineer's approval.

E. Surveyor: Engage a Land Surveyor licensed as a Professional Land Surveyor (PLS) in the state where the project is located to perform layout and verification of the work of this Section.

F. Material Certificates: Materials Certificates certify that the materials furnished conform to all applicable requirements of the Contract Documents. Materials Certificates shall be signed by a duly authorized and responsible agent for the organization supplying the material. Contractor shall be responsible for any testing, Materials Certificates, and inspections required. Materials Certificates shall also include the following information:

1. Project for which the material has been consigned.

2. Name of Contractor to which material is supplied.

3. Item number and description of material.

4. Quantity of material represented by the certificate.

5. Means of identifying the consignment, such as label, marking, lot numbers, etc.

6. Date and method of shipment

1.6 TESTING, PRE-CONSTRUCTION

A. All pre-construction sampling/testing shall be the responsibility of Contractor. Contractor shall retain and pay for the services of a third-party Sampling and Testing Laboratory and/or Testing

Agency to perform all sampling/testing services in accordance with applicable standards and these specifications.

B. Material Testing

1. Provide testing data for the following:

   a. Field Base, Bottom Stone

   b. Field Base, Top Stone

   c. Collector Pipe Stone, Bottom Stone

   d. Collector Pipe Stone, Top Stone

2. Testing parameters:

   a. Moisture-Dry Density Curve (Proctor Test-Modified): ASTM D1557

   b. Gradation: ASTM D422

   c. Resistance to Abrasion: ASTM C131

   d. Soundness: ASTM C88

   e. Chemical Testing: Contractor shall conduct chemical testing to demonstrate that such material is free of oils, hazardous materials, or other organic and non-organic constituents which may be considered contaminants. For each type/classification and source of earth material proposed, submit a letter signed by an authorized representative of the material supplier stating that such proposed earth material is free of oils, hazardous materials, or other organic and non-organic constituents which may be considered contaminants.

3. Testing Frequency: One test for each type of material per source of supply.

4. All required testing (sample and analysis) shall be submitted as part of one submittal or it will be rejected. Failure to include any of the above requirements will result in rejection.

C. Drainage Test, Pre-Construction

1. Construct a minimum 15-foot by 15-foot (15 ft x 15 ft) sample panel of the field subdrainage system (Geotextile, Field Base Bottom Stone, and Field Base Top Stone) on top of a prepared subgrade section in an area approved by Engineer.

2. Field subdrainage system sample panel shall be complete and in-place, representative of final construction per the Drawings and Specifications. Material testing and compaction testing on the sample panel shall be submitted to confirm the sample panel conforms to the drawings and specifications.

3. Perform an infiltration test, double-ring infiltrometer, ASTM F1551/EN 12616—Standard Test Method for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials, on the sample panel's Field Base Bottom Stone layer after placement and compaction. Alternative infiltration testing will not be considered valid.

a. Testing criteria: The mock-up Field Base Bottom Stone layer of the sample panel will be considered acceptable when an infiltration rate of no less than 30 inches per hour (30 in/hr) is demonstrated.

4. Perform an infiltration test, double-ring infiltrometer ASTM F1551/EN 12616—Standard Test Method for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials, on the completed sample panel (top and bottom stone). Alternative infiltration testing will not be considered valid.

   a. Testing criteria: The mock-up field subdrainage system panel will be considered acceptable when an infiltration rate of no less than 20 inches per hour (20 in/hr) is demonstrated.

5. Sample panel may not be utilized as part of the final work. Remove the panel when testing is completed.

1.7 TESTING, QUALITY CONTROL DURING CONSTRUCTION

A. All quality control sampling/testing during construction shall be the responsibility of Contractor. Contractor shall retain and pay for the services of a third-party Sampling and Testing Laboratory and/or Testing Agency to perform all sampling/testing/inspection services in accordance with applicable standards and these specifications.

B. Material Testing

1. During construction, prior to the delivery of material to the Project Site, provide representative testing for the following materials:

   a. Field Base, Bottom Stone

   b. Field Base, Top Stone

   c. Collector Pipe Stone, Bottom Stone

   d. Collector Pipe Stone, Top Stone

2. Intent: The purpose of such testing is to monitor consistency in material characteristics during construction to ensure materials delivered to the Project Site demonstrate the same characteristics as those represented by Engineer-approved pre-construction material testing submittals.

   a. If testing indicates that materials demonstrate differing characteristics as indicated in Engineer-approved pre-construction material testing submittals, materials shall not be employed in the work. Any material represented by such sampling result which has been placed shall be removed from the Project Site and replaced with acceptable material at no expense to Owner.

   b. Contractor is solely responsible for coordinating the timing of sampling, testing, reporting, and Engineer's review. Allow Engineer 24 hours to review test results.

3. Testing parameters:

   a. Moisture-Dry Density Curve (Proctor Test-Modified): ASTM D1557

b. Gradation: ASTM D422

c. Resistance to Abrasion: ASTM C131

d. Soundness: ASTM C88

4. Testing Frequency: One test representing 10,000 square feet (1 test/10,000 sf) of in-place material.

C. Compaction Testing

1. Compaction Testing: ASTM D2922.

2. Additional compaction testing may be required when there is evidence of a change in the quality of moisture control or the effectiveness of compaction.

3. If testing indicates that compacted subgrade, backfill, or fill are below specified density, additional compaction and/or replacement of material shall be provided at no expense to Owner.

D. Drainage Testing

1. Collector Pipe, Bottom Stone

a. Perform infiltration tests, double-ring infiltrometer, ASTM F1551/EN 12616—Standard Test Method for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials, on the completed Collector Drain. Alternative infiltration testing will not be considered valid.

b. Testing Frequency: Perform two tests on opposite sides of the field.

c. Testing criteria: Each test will be considered acceptable when an infiltration rate of no less than 30 inches per hour (30 in/hr) is demonstrated. Do not proceed with turf installation until all tests are considered acceptable.

2. Collector Pipe, Top Stone

a. Perform infiltration tests, double-ring infiltrometer, ASTM F1551/EN 12616—Standard Test Method for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials, on the completed Collector Drain. Alternative infiltration testing will not be considered valid.

b. Testing Frequency: Perform two tests on opposite sides of the field.

c. Testing criteria: Each test will be considered acceptable when an infiltration rate of no less than 20 inches per hour (20 in/hr) is demonstrated. Do not proceed with turf installation until all tests are considered acceptable.

3. Field Base, Bottom Stone

a. Perform infiltration tests, double-ring infiltrometer, ASTM F1551/EN 12616—Standard Test Method for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials, as the Bottom Stone layer of the field subdrainage system/base is completed. Alternative infiltration testing will not be considered valid.

b. Testing Frequency: Perform one test for each 25,000 square feet (25,000 sf) of completed area.

c. Testing criteria: Each test will be considered acceptable when an infiltration rate of no less than 30 inches per hour (30 in/hr) is demonstrated. Do not proceed with installation of subsequent layers until all tests are considered acceptable.

4. Field Base, Top Stone

a. Perform infiltration tests, double-ring infiltrometer, ASTM F1551/EN 12616—Standard Test Method for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials, as the Top Stone layer of the field subdrainage system/base is completed. Alternative infiltration testing will not be considered valid.

b. Testing Frequency: Perform one test for each 25,000 square feet (25,000 sf) of completed field area.

c. Testing criteria: Each test will be considered acceptable when an infiltration rate of no less than 20 inches per hour (20 in/hr) is demonstrated. Do not proceed with turf installation until all tests are considered acceptable.

E. Surface Regularity:

a. The planarity of the finished grade of the field subdrainge system shall conform to EN 13036 Surface Planarity as performed by an independent Certified Testing Agency.

PART 2 PRODUCTS

2.1 FIELD DRAIN (FLAT PANEL)

A. Composite, pre-fabricated high density polyethylene (HDPE), 3-dimensional high-flow, drainage core with internal support pillars, wrapped with a filtration geotextile filter fabric, 1.5 inches by 13 inches. HDPE minimum cell classification: 424420C, ASTM D3350.

B. Couplers, tees, caps, and other fittings: As required to complete the system. Material of construction and configuration shall be in accordance with the drain manufacture's requirements or recommendations, whichever is more stringent. HDPE minimum cell classification: 424420C, ASTM D3350.

C. Geotextile Filter Fabric

1. Grab Tensile Strength (weakest principle direction), ASTM D4632: 120 pounds

2. Grab Elongation (weakest principle direction), ASTM D4633: 60%

3. Trapezoidal Tear (weakest principle direction) ASTM D4533: 40 pounds

4. Puncture, ASTM D3786: 30 pounds

5. Permittivity, ASTM D4491: 0.7

6. AOS (U.S. Sieve Size), ASTM D4751: 60

7. U.V. Resistance, ASTM D4355: 70

2.2 COLLECTOR PIPE

A. Perforated Corrugated Polyethylene Pipe: AASHTO M252 Type SP (Double Wall) as indicated on the Drawings.

1. Perforations: Class 2 slotted perforations per AASHTO M252. Perforations shall be uniformly spaced along the length and circumference of the pipe.

2. Joints: Joint: Silt-tight, ASTM D3212.

2.3 FIELD BASE, BOTTOM STONE

A. Product resulting from the artificial crushing of rocks, boulders or large cobblestones, substantially all faces of which have resulted from the crushing operation. Material shall consist of sound, tough, durable, angular stones, free from soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces, feldspar, limestone, marble, deteriorated granite, mud, dirt, organic matter, or other deleterious material. The presence of soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces, feldspar, limestone, marble, mud, dirt, organic matter, or other deleterious material will be cause for rejection at Engineer's discretion.

1. Testing and evaluation of material by the testing laboratory shall evaluate material composition for the presents of feldspar or micaceous materials and note same on testing report. Material may be rejected due to the presence of feldspar or micaceous materials.

B. Test for Resistance to Abrasion, ASTM C131. Materials shall show a loss on abrasion of not more than 30%.

C. Soundness, ASTM C88. Coarse aggregate shall not have a loss of more than 15% at the end of five cycles.

D. Gradation:

Gradation of Bottom Stone (ConnDOT M.01.01, No. 67)

Sieve	Percent Passing by Weight
1″	100
¾″	90–100
⅜″	20–55
No. 4	0–10
No. 8	0–5

2.4 FIELD BASE, TOP STONE

A. Product resulting from the artificial crushing of rocks, boulders or large cobblestones, substantially all faces of which have resulted from the crushing operation. Material shall consist of sound, tough, durable, angular stones, free from soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces, limestone, marble, deteriorated granite, mud, dirt, organic matter, or other deleterious material. The presence of soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces, feldspar, limestone, marble, mud, dirt, organic matter, or other deleterious material will be cause for rejection at Engineer's discretion.

1. Testing and evaluation of material by the testing laboratory shall evaluate material composition for the presents of feldspar or micaceous materials and note same on testing report. Material may be rejected due to the presence of feldspar or micaceous materials.

B. Test for Resistance to Abrasion, ASTM C131. Materials shall show a loss on abrasion of not more than 30%.

C. Soundness, ASTM C88. Coarse aggregate shall not have a loss of more than 15% at the end of five cycles.

D. Gradation:

Gradation of Top Stone

Sieve	Percent Passing by Weight
½″	100
⅜″	90–100
¼″	75–90
No. 10	15–35
No. 30	5–15
No. 40	0–10
No. 100	0–5
No. 200	0–2

2.5 COLLECTOR PIPE STONE, TOP STONE

A. Product resulting from the artificial crushing of rocks, boulders or large cobblestones, substantially all faces of which have resulted from the crushing operation. Material shall consist of sound, tough, durable, angular stones, free from soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces, feldspar, limestone, marble, deteriorated granite, mud, dirt, organic matter, or other deleterious material. The presence of soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces, feldspar, limestone, marble, mud, dirt, organic matter, or other deleterious material will be cause for rejection at Engineer's discretion.

1. Testing and evaluation of material by the testing laboratory shall evaluate material composition for the presents of feldspar or micaceous materials and note same on testing report. Material maybe rejected due to the presence of feldspar or micaceous materials.

B. Test for Resistance to Abrasion, ASTM C131. Materials shall show a loss on abrasion of not more than 30%.

C. Soundness, ASTM C88. Coarse aggregate shall not have a loss of more than 15% at the end of five cycles.

D. Size: ⅜ inch, double washed.

2.6 COLLECTOR PIPE STONE, BOTTOM STONE

A. Product resulting from the artificial crushing of rocks, boulders or large cobblestones, substantially all faces of which have resulted from the crushing operation. Material shall consist of sound, tough, durable, angular stones, free from soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces, limestone, marble, deteriorated granite mud, dirt, organic matter, or other deleterious material.

1. Testing and evaluation of material by the testing laboratory shall evaluate material composition for the presents of feldspar or micaceous materials and note same on testing report. Material maybe rejected due to the presence of feldspar or micaceous materials.

B. Test for Resistance to Abrasion, ASTM C131. Materials shall show a loss on abrasion of not more than 30%.

C. Soundness, ASTM C88. Coarse aggregate shall not have a loss of more than 15% at the end of five cycles.

D. Size: ¾ inch, double washed.

2.7 GEOTEXTILE

A. Composition: Nonwoven, polypropylene fibers.

B. Physical properties:

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Grab Tensile Strength, Ultimate	ASTM D4632	Pounds	120
Grab Tensile Strength, Elongation at Utlimate	ASTM D4632	Percent (%)	50
Trapezoid Tear Strength	ASTM D4533	Pounds	50
Mullen Burst Strength	ASTM D3786	psi	225
Puncture Strength	ASTM D4833	Pounds	60
Apparent Opening Size (AOS)	ASTM D4751	U.S. Sieve	70
Permittivity	ASTM D4491	sec^{-1}	1.8
Flow Rate	ASTM D4491	$gal/min/ft^2$	135
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70
Physical Properties	Test Method	Unit	Average Roll Value
Weight	ASTM D5261	oz/yd^2	4.5
Thickness	ASTM D5199	Mils (mm)	44 (1.12)

PART 3 EXECUTION

3.1 GENERAL

A. Notify "Call-Before-You-Dig" to request a utility mark-out for the Project Site prior to any earth disturbance. Provide written confirmation to Engineer that such mark-out has been completed.

B. Verify site conditions before proceeding with demolition work. Field check the accuracy of the Drawings and inspect structures, utilities, and other site features prior to start of work and notify Engineer in writing, of any discrepancies or hazardous conditions.

C. Take precautions for preventing injuries to persons or damage to property in or about the work. Protect structures, utilities, adjacent athletic facilities, walks, pavements and other improvements from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

D. Protect sub-grades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

E. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 PROGRESS SURVEY

A. Retain and pay for the services of a Professional Land Surveyor who will be responsible for the verification of the work of this Section. Complete Progress Surveys for:

1. Completed subgrade elevations.

2. Completed field subdrainage system elevations and drain locations, including collector pipe and flat panel piping.

B. Complete surveys to verify that the specified lines, grades, and cross sections of the project elements and/or systems as indicated on the Drawings have been achieved, or that the lines, grades, and cross sections of the system required to achieve final field elevations indicated on the Drawings have been achieved.

C. Prepare Progress Survey depicting the area and elevations of each finished system for review by Engineer and turf installer. Drawing shall be prepared based on a 20 foot grid with spot grades to the nearest 0.01 foot. In addition to spot grades, Contractor shall pull string lines at each inlaid line location and at 15 foot intervals to identify high and low spots. This includes all lines. Depict locations of string lines on Progress Survey.

D. Tolerance: Correct grades that deviate more than ¼ inch from required elevations.

3.3 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrade and from flooding Project site and surrounding area.

B. Protect subgrade from softening, undermining, washout and damage by rain or water accumulation.

3.4 SUBGRADE

A. Formation: Form and shape subgrade to the specified lines, grades, and cross-sections indicated on the Drawings, or to the lines, grades, and cross-sections required to achieve final field elevations indicated on the Drawings. Refer to Section 31 2310—Earthwork.

1. All soft and yielding material and other portions of the subgrade which will not compact readily shall be removed and replaced with suitable material. Utilize Granular Fill, Processed Aggregate, or other Engineer-approved material as required.

2. Reconstruct sub-grades damaged by freezing temperatures, frost, rain, accumulated water or construction activities, as directed by Engineer.

B. Compaction: The entire area of the subgrade shall be uniformly and thoroughly compacted by use of compaction equipment consisting of rollers, compactors or a combination thereof.

1. Earth-moving and other equipment not specifically manufactured for compaction purposes will not be considered as compaction equipment.

C. Approval of Subgrade: Examine the subgrade of the field for horizontal and vertical conformance, compaction, and general suitability.

1. Evidence of inadequate subgrade shall be brought to the immediate attention of Engineer.

2. Areas of potential ponding shall be corrected.

3. Confirm planarity requirements of subgrade based on a 20-foot grid. Grid shall be laid out and a level-set laser system used to determine elevation compliance.

a. Construction Tolerance: Re-grade areas that are not within ¾ inch of required elevations.

3.5 GEOTEXTILE

A. Install geotextile as shown on the Drawings or as called for in the Specifications. Installation methods shall comply with manufacturer's written instructions.

B. Ensure that geotextile is protected during installation from clogging, tears, and other damage.

1. Layer Separation and Stabilization

a. Place fabric on a normally prepared subgrade area attending the full width of the sub-base layer being protected.

b. Place fabric in a loose and unstretched condition to minimize shifting, puncture, and/or tearing. Overlap fabric roll-ends and edges a minimum of 12 inches with adjacent material.

c. Place Bottom Stone material within 2 weeks after placement of fabric to minimize exposure. Place sub-base material in a manner to minimize slippage of the fabric. If excessive slippage occurs, use steel securing pins per manufacturer's guidelines.

2. Pipe or Drainage System

a. Provide smooth side and bottom trench surfaces so the fabric does not bridge depressions in the soil and is not damaged by rock projections.

b. Use fabric of a width to permit a minimum trench-width overlap across the backfill at the trench top.

c. Lay the fabric flat in the prepared trench without stretching. Lay the top of the fabric back on the sides to allow for the placement of the aggregate backfill and pipe.

d. Overlap ends of rolls an amount equal to the trench width prior to fabric placement. Where pockets or cavities occur in the trench bottom or sides, fill them with acceptable granular material to prevent distortion or damage to the fabric.

e. Backfill aggregate and install pipe in a manner to prevent damage to the fabric. Compact aggregate backfill and overlap the fabric across the trench top. Do not allow the fabric to be exposed for more than 2 weeks without covering with backfill.

3.6 FLAT PANEL DRAIN

A. Install flat panel drains as indicated on the Drawings.

B. Install all drain components in accordance with the manufacturer's instructions.

3.7 DRAINAGE STONE, BOTTOM STONE AND TOP STONE

A. Confirm placement of flat panel drains prior to initiating installation of Bottom Stone.

B. Conduct and submit material testing in accordance with Article 1.7

C. Installation

1. Install each layer of stone as indicated on the Drawings.

2. Bottom Stone: Install in two lifts, compacted to required density.

3. Top Stone: Install in a single lift and compact to required density

4. Maintain dozer, grader, or loader push distances below 75 feet to minimize segregation of course-graded fractions from fine-graded fractions, as well as not overwork the material.

5. Installed layers shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with drainage stone. Materials spilled outside specified lines shall be removed and areas repaired.

6. Portions of drainage layer which become contaminated, softened, or dislodged by passing of equipment, or otherwise damaged, shall be cleaned, replaced, and otherwise repaired to conform to the requirements of this specification.

D. Compaction

1. Compact lifts using a 6 ton steel wheel roller or vibratory roller equivalent to a 6-ton static roller, or approved equivalent.

2. Rolling shall begin at sides and progress to center of crowned areas, and shall begin on low side and progress toward high side of sloped areas. Rolling shall continue until material

does not creep or wave ahead of roller wheels. Roll material until a firm, stable surface is achieved. Do not over-compact. Over-compacted material shall be removed and replace at Contractor's expense.

E. Final Grading

1. Utilize a laser-guided grader to complete fine grading of the finish surface of the field subdrainage system. Laser control system shall control each side of the blade independently. Single post control systems are not acceptable.

2. Minimize movement of machinery or equipment over completed work. Repair any ruts or other deviations.

3. Surface Regularity: The planarity of the finished grade of the field subdrainge system shall conform to EN 13036 Surface Planarity as performed by an independent Certified Testing Agency.

   a. Deviations shall be measures below a straightedge using a graduated wedge (slip gauge). No deviation shall exceed 10mm.

4. Protection

   a. Where the activities of Contractor have been determined by the Engineer to have caused damage or contamination of the dynamic stone material the Contractor shall remove and replace all affected areas to the satisfaction of Engineer.

   b. Where weather conditions have created erosion of topping stone material or migration of fine material such that it concentrates in areas on the drainage stone surface (such as runoff causing migration of fines), these areas shall be cleaned of all fine material and replaced with new material.

3.8 PERIMETER COLLECTOR DRAIN

A. Install drain pipe and bedding system as indicated on the Drawings.

B. Installed drains shall be kept clean and uncontaminated. Less select materials shall not be permitted to become mixed with drainage stone.

3.9 DRAINAGE TESTING

A. Complete post-installation drainage testing of the installed field subdrainage system/base in accordance with Article 1.7.

3.10 CLEAN UP

A. Contractor shall remove all debris, residuals, and materials at the conclusion of the work.

END OF SECTION

APPENDIX

Avon High School Athletic Facility Stormwater Management Report
Geotechnical Engineering Report
Athletic Field Irrigation Sketches
1995 Boundary and Topographic Survey

STORMWATER MANAGEMENT REPORT

Avon High School Athletic Facility
510 West Avon Road
Suffield, Connecticut

October 2018

PREPARED FOR:

Town of Avon
60 West Main Street
Avon, Connecticut 06001

PREPARED BY:

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1.0 INTRODUCTION

This Stormwater Management Report contains the engineering design of the stormwater management systems for the Avon High School Athletic Facility, located at 510 West Avon Road in Avon, Connecticut. The engineering design presented in this report is prepared in accordance with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control, the 2004 Connecticut Department of Energy & Environmental Protection (CT DEEP) Water Quality Manual, the 2000 Connecticut Department of Transportation (ConnDOT) Drainage Manual, and the Town of Avon guidelines and regulations.

2.0 EXECUTIVE SUMMARY

This report is prepared for the Town of Avon, Connecticut for the stormwater management design of a new artificial grass sports field, a replacement of the existing track and associated field event runways, and the addition of new site walks.

The following stormwater management facilities are designed in accordance with the Town of Avon Regulations, CT DEEP, and ConnDOT Standards:

- The increase in peak site runoff, for the 2-year through 100-year storm is mitigated under proposed conditions. The proposed synthetic grass field stone cross sections detain stormwater runoff while providing an extended interface between natural sub-soil, allowing a substantially higher potential for groundwater recharge.
- Short-term erosion control during construction will be achieved through use of construction entrances, silt fence and hay bale barriers, and temporary diversion swales.
- Long-term stormwater quality is provided via treatment train, including catch basins with sumps and detention of the water quality volume via the synthetic turf field. The water quality measures are designed to meet the 2004 CT DEEP Stormwater Quality Manual guidelines.
- Stormwater piping is designed to convey the 10-year design storm, per Town of Avon Regulations.

3.0 PROJECT DESCRIPTION

The portion of this project associated with this report includes the design and construction of a synthetic grass field, bituminous track, sidewalks, bleachers, and other associated site appurtenances. The site is located on a 30-acre parcel at 510 West Avon Road, with the area of disturbance approximately 5.90 acres. A Site Location Map is included as Figure 1.

4.0 EXISTING CONDITIONS

4.1 Characteristics

The project site will be a reconstruction of the existing Avon High School athletic facilities. The existing site is currently comprised of a natural grass field, a bituminous 6-lane track, two (2) bituminous field event runways, bituminous walks, and bleachers.

The site is bounded by West Avon Road to the west, Avon High School to the north, a natural grass baseball field to the east, and residential properties to the south. Access to the site will be off of West Avon Road at the northwest corner.

4.2 Soil

Following research of the USDA-NRCS Web-soil Survey online database, virtually 100 percent of the site is recorded as Udorthents, Urban Land Complex. The main characteristic of Udorthents is that the material present is not the native soil formation. Representative areas typically have been cut or filled by at least two feet above or below the original soil landmass. With Urban Land complex, typically non-native, inorganic components are included in the Udorthents fill material, that could represent construction debris or general fill from large amounts of historical earthwork

Although the NRCS classification would allow the soil to be classified as Hyrdologic Soil Group B, the hydrologic computations were performed using Hydrologic Soil Group D. It was assumed that due to the nature of the existing site use (high school and associated parking and athletic facilities), the soils would be very compacted and likely to contain foreign and non-soil materials, allowing for very poor infiltration.

4.3 Existing Hydrology

The high point of the site is the entrance driveway that runs along the northern edge. From there, the site generally slopes down toward the south, with the local low point being a drainage manhole with an inlet located at the southern-most point of the site.

Currently, there are very little drainage or stormwater management facilities servicing the site. All stormwater runoff is directed towards the existing drainage manhole inlet at the southern-most point. According to the existing topography, the natural grass field is a local low point, and likely functions similarly to a detention basin during significant storm events. Additionally, there are multiple areas within the site where water is likely to pond during storm events, given the nature of the soils and the lack of drainage facilities.

For the existing hydrologic study, the site has been subdivided into the following three (3) subwatersheds:

Subwatershed E1-1 is an area of approximately 4.35 acres and consists of the track and field, the northern portion of the site, and a section of West Avon Road in the northwest corner. Runoff in this subwatershed is directed to the low point in the field, which functions as a detention pond until water overtops the edge of the track and discharges into the existing drainage manhole inlet.

Subwatershed E1-2 is an area of approximately 3.45 acres and consists of the athletic fields to the east of the site. Runoff in this subwatershed is directed to a drainage swale that runs along the south edge of the property that ultimately flows into the existing drainage manhole inlet.

Subwatershed E1-3 is an area of approximately 2.14 acres and consists of a section of West Avon Road and the western portion of the site. Runoff in this subwatershed flows between the existing bleachers and the western edge of the track and then down-slope to the existing drainage manhole inlet.

5.0 STORMWATER MANAGEMENT

5.1 Design Objective

The intent of the project hydrological study is to determine rates of runoff for maximum storm frequencies of two, ten, twenty-five, and 100-year intervals under existing and proposed conditions for the designated offsite discharge points. From this analysis, the proposed stormwater collection and

management system is designed to mitigate the post development increase in the peak rates of runoff for the above-mentioned storm events associated with the athletic facility construction. The stormwater management system also minimizes the impacts to the existing site drainage patterns and resource areas.

5.2 Design Criteria

This project is designed in accordance with the Town of Avon Regulations.

The following total rainfall amount for Hartford County is used for each storm event over a 24-hour period:

2-year, 24-hour storm – 3.42 inches
10-year, 24-hour storm – 5.50 inches
25-year, 24-hour storm – 6.80 inches
100-year, 24-hour storm – 8.81 inches

* Source: NOAA Atlas 14 Point Precipitation Frequency Estimates for Avon, Connecticut

5.3 Design Methodology

BSC prepared this study using methods contained in the USDA Soil Conservation Service Publication TR-55 "Urban Hydrology for Small Watersheds". TR-55 outlines procedures for calculating peak rates of runoff resulting from precipitation events and procedures for developing runoff hydrographs.

Each watershed is simulated as a series of contributing subcatchments, and inflow and outflow structures. Values for area, curve number (CN) and time of concentration (Tc) are calculated for each contributing subcatchment.

The curve number is a land sensitive coefficient that dictates the relationship between total rainfall depth and direct storm runoff. Based on the coverage of soil groups and land use in the watershed, an average CN is determined for each subcatchment under existing and proposed conditions.

The USDA defines the "time of concentration" as the time for runoff to travel from the hydraulically most distant point in the watershed to a point of interest (usually the discharge point). We determined values for the time of concentration for both the existing and proposed conditions based on land cover and slope of the flow path using methods described in TR-55.

Values for the time of concentration (Tc), curve number (CN), and subwatershed area were entered into the "HydroCAD 10.0" computer program (based on TR-20 and TR-55) to calculate subcatchment hydrographs for each area being analyzed.

Initially, a hydrological analysis of the existing conditions model was conducted to establish the existing peak rates of runoff for storm events identified above. BSC continued with an evaluation of the proposed conditions model to obtain an accurate comparison.

For the purposes of this study, BSC selected the 24-hour duration type III distribution storm as the design storm and twenty-four (24) hour rainfall depths for the two, ten, twenty-five and 100-year storms were considered.

5.4 Existing Conditions

As previously indicated, the site is comprised of one (1) watershed, subdivided into three (3) subwatersheds based on different characteristics.

Cover characteristics, area, CN, and Tc of each subwatershed are presented in the table below:

Subwatershed	Area (ac)	CN	Tc (min.)
E1-1	4.35	85	16.2
E1-2	3.45	81	22.9
E1-3	2.14	85	15.4
Total	**9.94**	**83.6**	**-**

An Existing Watershed Area Map is included as Figure 2. Existing stormwater discharge computations are included in Appendix A.

5.5 Proposed Conditions

The intent of the hydrologic design was to maintain, and reduce if possible, peak flows for each subwatershed.

The proposed site will continue to discharge to the same watershed, and has been subdivided into the following four (4) subwatersheds:

Subwatershed P1-1 is an area of approximately 3.50 acres and consists of the track and synthetic grass field. Runoff in this subwatershed infiltrates through the synthetic grass, through the top stone layer, and then it flows horizontally through the bottom stone layer towards the perforated underdrains. It is this movement of the flow that allows the synthetic grass field to have a very high time of concentration, allowing for a large amount of underground storage during significant storm events. Once runoff reaches the underdrains, it is directed into the proposed drainage system, which ultimately discharges into the existing drainage manhole at the south of the site. Calculations for the synthetic grass field time of concentration can be found in Appendix D.

Subwatershed P1-2 is an area of approximately 2.33 acres and consists of the area surrounding the track to the east and the north, as well as a portion of West Avon Road. Runoff in this subwatershed is directed to a series of area drains that ultimately convey the flow via underground stormwater piping to the existing drainage manhole.

Subwatershed P1-3 is an area of approximately 2.25 acres and consists of the athletic fields to the east of the site. Runoff in this subwatershed, similarly to Subwatershed E1-2, is directed toward a drainage swale along the southern edge of the property, which ultimately discharges into the existing drainage manhole inlet.

Subwatershed P1-4 is an area of approximately 1.86 acres and consists of the western edge of the site, a portion of West Avon Road, and the southwestern corner of the site. Runoff in this subwatershed is directed via overland flow to the existing drainage manhole inlet.

Cover characteristics of each subwatershed are presented in the table below:

Subwatershed	Area (ac)	CN	Tc (min.)
P1-1	3.50	98	366.0
P1-2	2.33	85	18.7
P1-3	2.25	81	22.3
P1-4	1.86	85	15.3
Total	**9.94**	**88.7**	**-**

A Proposed Watershed Area Map is included as Figure 3. Proposed stormwater discharge computations are included in Appendix B.

5.6 Pre- and Post-Comparison

Peak flows at the offsite analysis point are shown in the following tables:

Comparison of Existing to Proposed				
Watershed	**Storm Event (Type III)**	**Discharge Existing (cfs)**	**Discharge Proposed (cfs)**	**Discharge Difference (cfs)**
Total Site	**2-year**	14.65	9.66	-4.99
	10-year	29.23	19.20	-10.03
	25-year	38.50	25.27	-13.23
	100-year	51.76	34.66	-17.10

The data summarized above indicates that the peak stormwater discharge will be reduced from the existing condition to the proposed conditions for all of the design storms.

6.0 STORMWATER DRAINAGE

6.1 Design Criteria

Design of the storm drainage system is performed in accordance with the standards and procedures specified in the 2000 ConnDOT Drainage Manual. The specified piping for the site and perimeter area drain systems are sized to convey the 10-year, 24-hour design storm, as required by the Town of Avon.

6.2 Design Methodology

The storm drain collection system was analyzed using the Rational Method for estimating runoff for a 10-year design storm. The site was divided into sub-areas, with each contributing runoff to an individual catch basin inlet. A value for area, time of concentration, and a runoff coefficient, was calculated for each contributing sub-area.

Values for time of concentration were chosen based on land cover and slope of the flow path from the hydraulically most distant point in the sub-area to the appropriate inlet. Per the Rational Method, the minimum time of concentration value was assumed to be 5 minutes. Using the time of concentration, rainfall intensities were determined using the Rainfall-Duration-Frequency Relationships for Connecticut (Table B-2 in the ConnDOT Drainage Manual – October 2000). The average runoff coefficient, which is the ratio of peak runoff rate to the average rainfall rate for the period known as the time of concentration, was chosen using the following values:

Condition	C
Grass/Landscaped Areas	0.30
Pavement/Impervious Areas	0.90

Storm drainage pipes were then sized based upon calculated flows using Manning's Equation and the pipe sizes verified by solving for the hydraulic grade line. The drainage pipe material proposed for this project is High Density Polyethylene Pipe (HDPE).

Per the ConnDOT Drainage Manual (Table 6.C.1), the friction factor (n) utilized in the design was 0.011 for HDPE pipe with smooth interior.

6.3 Storm Drain Discharge Summary

Runoff from the site will be collected by area drains or directed via sheet flow to the existing drainage manhole inlet. Runoff from the track and field will be collected by a series of underdrains and a perimeter collector drain.

Detailed calculations for the on-site stormwater pipe sizing are included in this report in Appendix C. A Catchment Area Map is also included (Figure 4) to detail the tributary area for each drainage structure.

7.0 STORMWATER QUALITY

The project has been designed to address both the short-term and long-term stormwater quality. During construction, stormwater runoff is a concern due to the excess amount of exposed areas that do not have vegetation or other cover to prevent the removal and transportation of sediment to resource areas. The project addresses the short-term concerns by providing erosion control measures in the form of Erosion & Sediment Control Plans and a "During Construction" Operation and Maintenance Plan (Section 8.0). The primary function of erosion and sediment control, as defined by the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control is to "absorb erosional energies and reduce runoff velocities that force the detachment and transport of soil and/or encourage the deposition of eroded soil particles before they reach any sensitive area." The short-term project erosion measures were designed per the 2002 manual.

After construction, stormwater runoff is a concern because it may contain contaminants such as suspended solids, petroleum hydrocarbons, nutrients, heavy metals, and salts that may have adverse effects on water quality. The sources of the pollutants are generally associated with urban land use, including automobile exhaust, mechanical wear of vehicles, leaf litter, deicing salts and atmospheric deposition. The pollutants accumulate on the land surfaces and are washed off during storm events into the receiving waterways and wetlands.

The objective of the stormwater management system designed for the proposed development is to effectively remove the contaminant loading from the site runoff and to provide long-term protection of the quality and use of downstream water resources. The long-term stormwater quality measures were designed per the 2004 Connecticut Stormwater Quality Manual. Stormwater quality calculations have been included in Appendix D.

7.1 Temporary Control of Sediment and Erosion

The objective of temporary erosion control during construction is to minimize the area of exposed soil, control runoff rate and direction, and provide for rapid stabilization of exposed areas. Prior to any construction activity, trenched silt fence and/or staked hay bales will be placed down gradient of the proposed work areas. The fence/barrier will provide some sediment control, as well as provide a limit of construction activity.

Construction entrances will be utilized to remove sediment from construction vehicle tires and prevent it from being tracked onto adjoining paved roadway areas.

Any excavated and stockpiled topsoil will be contained within staked hay bales and silt fence. Topsoil locations have been shown on the Erosion and Sediment Control (E&S) Plan. Erosion-prone areas to be left exposed for extended periods (>30 days) will be mulched and seeded for temporary vegetative cover. After construction, all exposed areas will be graded, mulched and re-vegetated with appropriate ground cover. The silt fence and/or hay bales will remain in place until groundcover is established.

Filter inserts will be used to collect sediment that may be carried in the storm runoff during construction. Filter inserts will be placed in each existing catch basin, yard drain, dry well, and in each new catch basin during construction and until all disturbed areas of the site have been stabilized. Replacement of the insert shall be as often as necessary to prevent excessive ponding due to clogged fabric.

Temporary diversion swales will be constructed to direct storm runoff away from disturbed areas. Stone or hay bale check dams will be installed at intervals along the swales to reduce the runoff velocity. In areas of excessive grade changes, temporary pipe slope drains will be constructed to convey runoff flows down the face of slopes without causing erosion problems. The diversion swales will outlet into temporary sediment traps.

Dewatering settling basins will be utilized where groundwater is encountered in trenching, foundation excavation, or any other excavation. The dewatering wastewaters will be infiltrated into the ground or discharged, after filtration into the nearest catch basin.

Throughout all phases of construction, the erosion control measures will be routinely inspected and cleaned, repaired, and replaced as necessary. See Section 8.0 entitled “Operation and Maintenance Plan” for more details.

Throughout the construction process, extra stocks of hay bales and silt fence will be kept on-site to replace those that become damaged and/or deteriorated.

Any erosion and sediment control measures, which, upon inspection, are found to be damaged, deteriorated or not functioning properly, will be repaired, replaced and corrected immediately after inspection.

Areas which are mulched or seeded for temporary vegetative cover will be inspected for proper cover at the end of each workday if precipitation is forecast and prior to weekends. Additional seeding or mulch will be placed as necessary.

The temporary erosion and sediment control systems will not be removed until all stormwater drainage system components are in place, cleaned and working properly and until permanent vegetative cover and other stabilization measures are established.

7.2 Permanent Control of Stormwater Quality

The design intent of the 2004 Connecticut Stormwater Quality Manual is to provide a "stormwater treatment train," where stormwater quality is achieved through a series of treatment measures. Harmful pollutants, such as sediment, pathogens, organic material, hydrocarbons, metals, synthetic organic chemicals and deicing compounds are carried by the low-flow storms. Many of these pollutants are associated with vehicular exhaust, engine leaks and deicing. Therefore, key areas of on-site treatment include parking lots and access drives since pollutants typically attach themselves to solid particles. Therefore, treatment practices are primarily designed to remove suspended solids.

The treatment train for this site includes:

- Parking lot sweeping
- Area drains with 2 foot sumps
- Detention basin (at downstream end of existing drainage pipe)

7.2.1 Water Quality Volume

The 2004 manual specifies that the water quality volume (WQV) is the amount of stormwater runoff from any given storm that should be captured and treated in order to remove a majority of stormwater pollutants on an average annual basis. Treatment of stormwater will be provided by the synthetic grass field drainage system. The runoff associated with this volume is associated with the first one-inch of rainfall. The WQV for the total post-development site is 0.24 acre-ft, or 10,245 cubic feet. Total water quality storage provided for this site is 21,142 cubic feet. Detailed WQV calculations can be seen in Appendix D.

7.2.2 Groundwater Recharge Volume

The 2004 manual specifies that the groundwater recharge volume (GRV) criterion is "intended to maintain pre-development annual groundwater recharge volumes by capturing and infiltrating stormwater runoff." The objective of the GRV criterion is to maintain water table levels, stream baseflow, and wetland moisture levels. As per the 2004 manual, a site that is comprised of hydrologic group "D" soils has an effective GRV value of zero, therefore no GRV has been provided or considered in this design.

8.0 OPERATION AND MAINTENANCE PLAN

8.1 During Construction

The following maintenance procedures shall be followed by the Contractor for temporary and permanent erosion and sedimentation measures and stormwater treatment systems installed during the construction period:

a. Dust Control: Moisten disturbed soil areas with water periodically, or use a non-asphaltic soil tackifier to minimize dust.

b. Temporary Seeding: Inspect weekly and within 24 hours of a storm with a rainfall generating a discharge. Continue inspection until vegetation is firmly established.

c. Permanent Seeding: Inspect seeded areas weekly and within 24 hours after a storm with a rainfall generating a discharge. Continue inspection until vegetation is firmly established.

d. Temporary Soil Protection: Inspect seeded areas weekly and within 24 hours after a storm with a rainfall generating a discharge.

e. Temporary Erosion Control Mat: Inspect mats weekly and within 24 hours after a storm with a rainfall generating a discharge.

f. Temporary Filter Inserts: Inspect the fabric at least once a week and within 24 hours after the end of a storm with a rainfall generating a discharge. Check the fabric for structural soundness (i.e. tears), proper anchoring/alignment within the grate and ability to drain runoff (i.e. percent of clogging by sediment). Remove the sediment every week, or sooner if ponding is excessive. Each time the sediment is removed, replace the section of fabric removed with a new section. Do not remove the sediment and reuse the same section of fabric.

g. Hay Bale/ Silt Fence Barrier: Inspect the barrier at least once a week and within 24 hours after the end of a storm with a rainfall generating a discharge. For dewatering operations, inspect frequently before, during and after pumping operations. Remove the sediment deposits when the depth reaches one half the barrier heights. Repair or replace a barrier within 24 hours of observed failure. Maintain the barrier until the contributing disturbed area is stabilized.

h. Construction Entrance/Exit Pad: Maintain the pad in a condition that will prevent tracking and washing of sediment onto paved surfaces. Place additional clean gravel on top of gravel that has become silted, or remove the silted gravel and replace the gravel to the depth removed with clean gravel, as conditions warrant. Remove immediately all sediment spilled, dropped, washed or tracked onto paved surfaces. Roads adjacent to the construction site shall be cleaned at the end of each day by hand sweeping or sweeper truck.

i. Dewatering Settling Basin (if used): Inspect the basin at least every two hours during periods of use. Remove accumulated sediments when the volume equals one half the provided storage volume.

j. Existing Catch Basins and Sumps: Inspect the sediment traps as specified in f. above. After final removal of the sediment traps at the end of construction, clean the sump of all silt and debris.

k. New Catch Basins and Sumps: As new catch basins are constructed, a sediment filter basket shall be installed in the unit and a sediment barrier installed around the grate. Inspect the basket

and barrier weekly and within 24 hours after a storm with a rainfall generating a discharge. After stabilization of the drainage area entering the catch basin, remove the trap and barrier and clean the basin sump of all silt and debris.

l. Stone or Hay Bale Check Dams: Inspect the check dam at least once a week and within 24 hours after the end of a storm with a rainfall generating a discharge. Remove the sediment deposits when the depth reaches one half the check dam heights. Repair or replace a check dam within 24 hours of observed failure. Maintain the check dam until the contributing disturbed area is stabilized.

m. Waterbars: Inspect the waterbars daily when exposed to vehicle traffic and within 24 hours after the end of a storm with a rainfall generating a discharge. Repair and reshape the waterbar immediately after observing any damages. Remove the sediment deposits when the depth reaches one half the waterbar heights. Maintain the waterbar until the contributing disturbed area is stabilized.

n. Temporary Diversion Swales & Pipe Slope Drains: Inspect at least once a week and within 24 hours after the end of a storm with a rainfall generating a discharge. Inspect daily when construction activities are in close proximity to the swales or slope drains. Repair damaged areas within 24 hours of observed failure. Maintain the swales and slope drains until the contributing disturbed area is stabilized.

o. Temporary Stockpiles: Inspect temporary stockpiles at the end of each workday to ensure that tarps are in place and secured. Temporary stockpiles that are expected to be inactive for more than 30 days should be temporarily seeded (see above).

p. Temporary Sediment Traps: Inspect monthly and within 24 hours after a storm with a rainfall generating a discharge. Sediment and oil shall be removed when the storage volume is reduced by one half, or at least every 6 months during construction.

During construction, the Contractor shall be required to remove accumulated sediment from sediment control measures and water quality measures. Sediment shall be disposed of off-site in a manner and location approved by local and state agencies. Temporary storage of sediment on-site is permissible if it is protected from erosion and stockpiled in a manner that will prevent it from being carried by erosion into adjacent properties or resource areas.

Temporary sediment traps may be removed if the contributing drainage area is stabilized. The area shall be re-graded to match original grades or proposed grades as shown on the plans. The disturbed area shall be temporarily, or permanently seeded and mulched if the area is not to be paved.
For hay bale barriers, the stakes may be removed as soon as the upslope areas have been permanently stabilized. Unless proposed construction requires otherwise, any accumulated sediment shall be left in place and the hay bales left in place or broken up for ground cover.

Upon the stabilization of the contributing drainage area, silt fence shall be inspected for sediment accumulation prior to removal. For sediment depths greater than 6”, the sediment shall be re-graded or removed. The silt fence shall be removed by pulling the support posts and cutting the geotextile at the ground level. Re-grade or remove the sediment as necessary and stabilize the disturbed soils by placing temporary or permanent seeding and mulch.

When dewatering has been completed, remove the hay bale barrier, sediment and stone, as appropriate, and re-grade the area to original or proposed grade. Stabilize the disturbed area with temporary or permanent seed and mulch.

After the drainage areas to the new and existing catch basins have been stabilized, the Contractor shall be required to clean all sumps and hoods of debris and silt. In addition, within the limits of work, the Contractor shall clean all storm drain piping of collected silt and debris by flushing with water. If the storm system discharges to ground, a hay bale and silt fence barrier must remain in place at each outfall to capture any sediment or debris carried down by the flushing. If the stormdrain system discharges into a public or private drainage collection system, the Contractor must install a means of collecting debris and filtering the sediment from the flushing water in the on-site storm system before discharge to the existing storm system.

8.2 After Construction

After construction is completed and accepted by the Owner, it shall be the responsibility of the City of Milford to maintain all drainage structures. In addition, the following inspection and maintenance guidelines shall be the responsibility of the Owner, or the Owner's representative, beginning the first year period following construction completion and acceptance, and shall be followed each year thereafter:

a) Parking Lot and Site Cleanup: Inspect on a regular basis not to exceed weekly for litter and debris.

b) Parking Lot and Driveway Sweeping: At least twice a year, with the first occurring as soon as possible after snowmelt and the second not less than 90 days following the first.

c) Catch Basin Sumps: Shall be inspected semi-annually and cleaned when the sump is one half full of silt and / or debris.

d) Landscaped Areas: Inspect semi-annually for erosion or dying vegetation. Repair and stabilize any bare or eroded areas and replace vegetation as soon as possible.

9.0 CONCLUSION

The project has been designed to meet Town and State requirements for stormwater management, drainage sizing, and stormwater quality. Peak flows generated by the site for the two, ten, twenty-five and 100- year storms have been mitigated to less than peak flows under existing conditions. The drainage system has been designed to convey the 10-year design storm and both stormwater quality and erosion control is included which meet the State erosion and sedimentation requirements.

LIST OF FIGURES/DRAWINGS

Figure 1 – Site Location Map

Figure 2 – Existing Watershed Area Map

Figure 3 – Proposed Watershed Area Map

Figure 4 – Catchment Map

FIGURE 1
Site Location Map

Figure 1 – Site Location Map

Avon High School Athletic Facility

510 West Avon Road

Avon, Connecticut

Scale = 1:24,000

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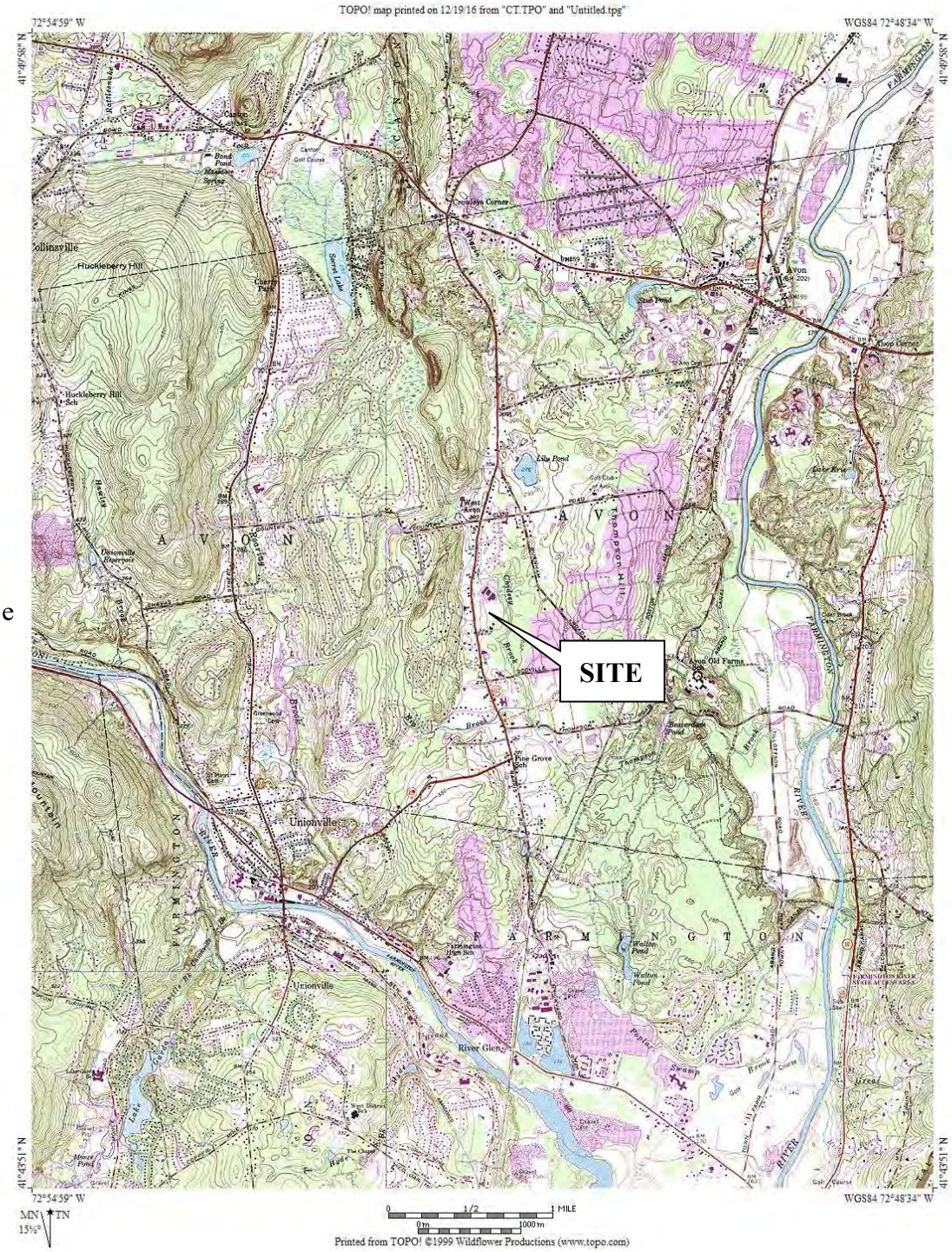
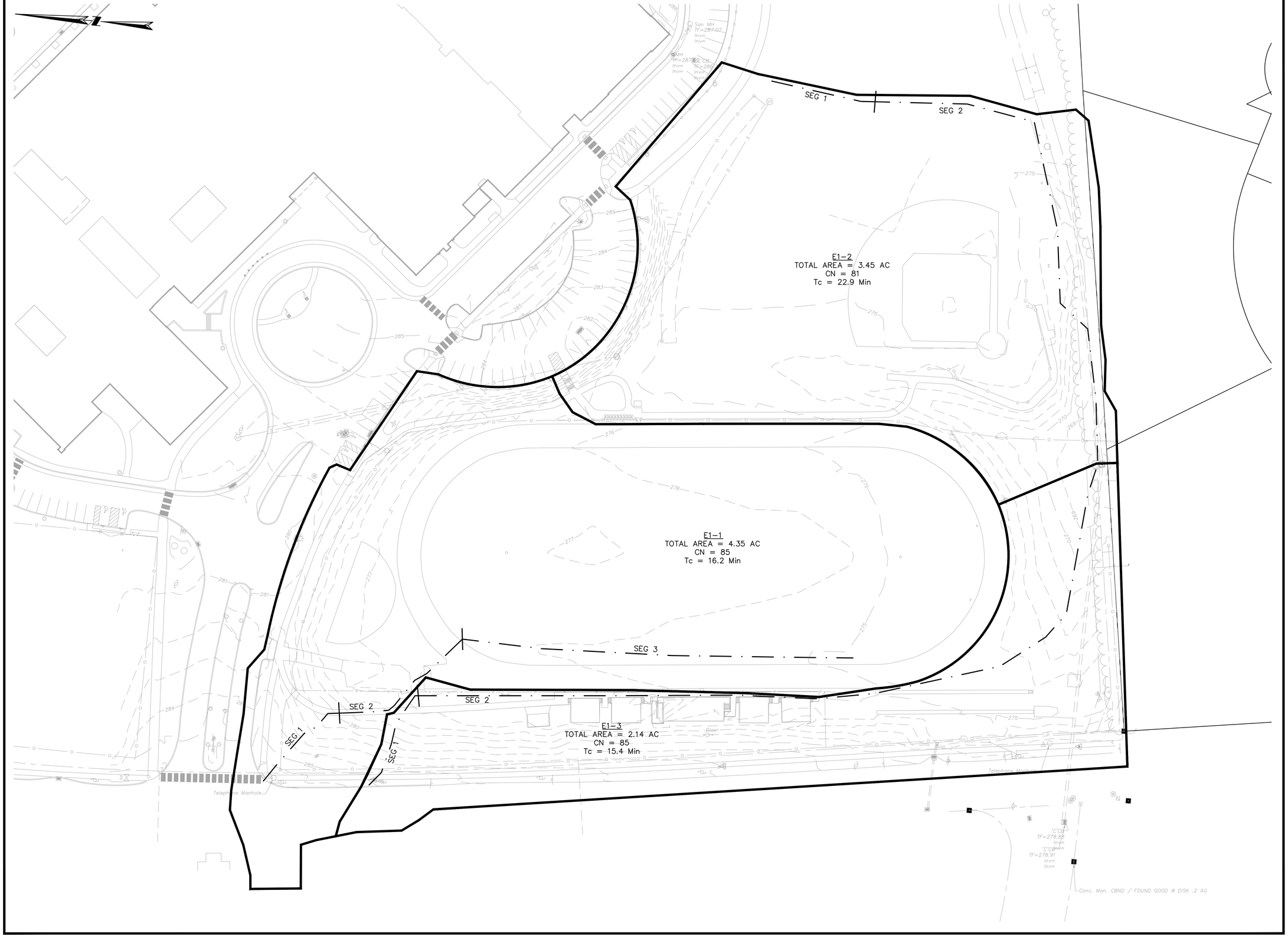


FIGURE 2
Existing Watershed Area Map



ATHLETIC FACILITY IMPROVEMENTS AT AVON HIGH SCHOOL

510 WEST AVON ROAD

IN

AVON
CONNECTICUT

EXISTING WATERSHED AREA MAP

SEPTEMBER 26, 2018

REVISIONS:

PREPARED FOR:

TOWN OF AVON
60 WEST MAIN STREET
AVON, CT 06001

BSC GROUP
300 Winding Brook Drive
Glastonbury, Connecticut 06033
860 652 8227

SCALE: 1" = 40'

0 20 40 80 FEET

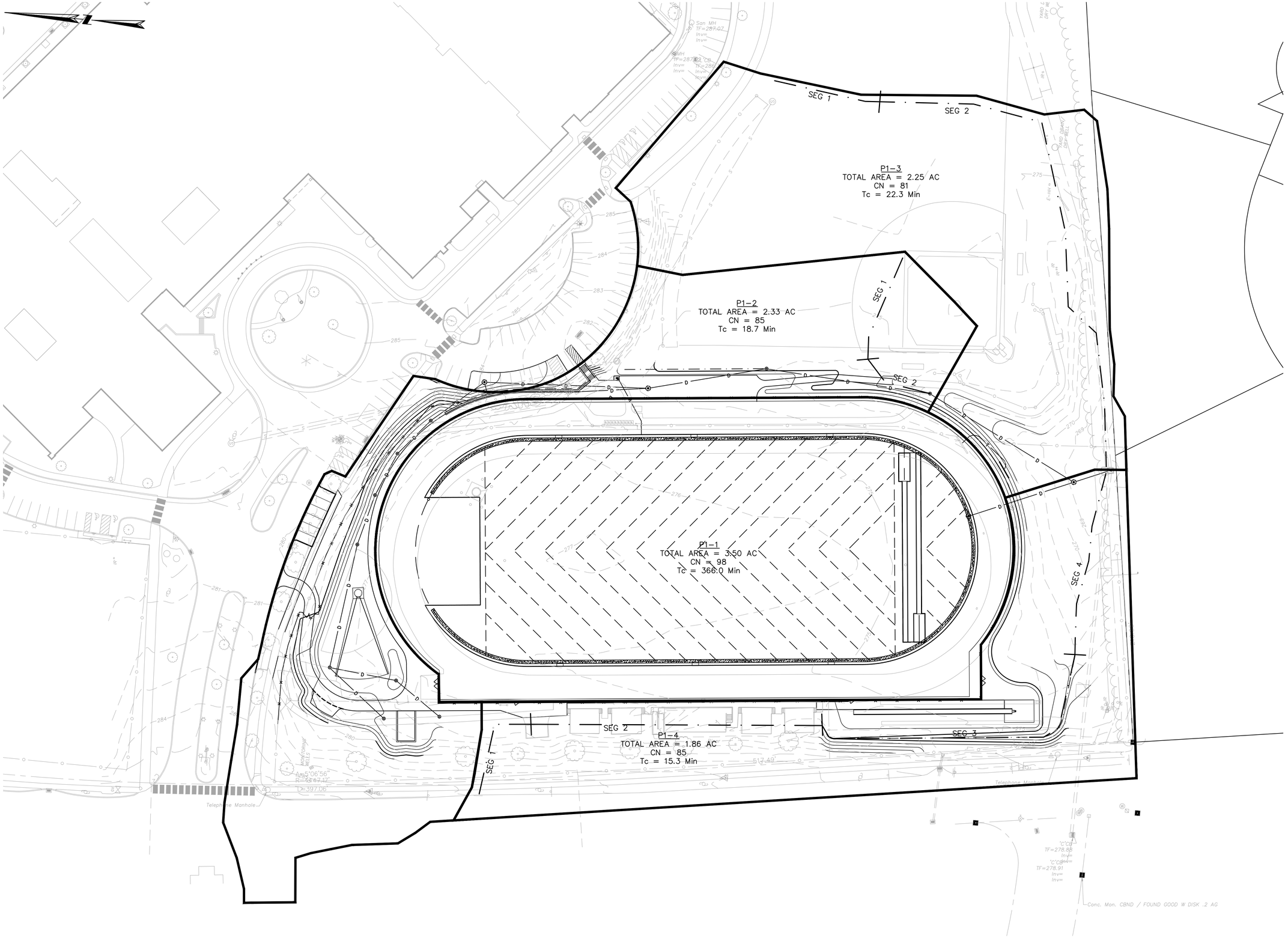
FILE: 8357202-EWAM.DWG

DWG. NO:

JOB. NO: 83572.02

FIGURE 2

FIGURE 3
Proposed Watershed Area Map



ATHLETIC FACILITY IMPROVEMENTS AT AVON HIGH SCHOOL

510 WEST AVON ROAD

IN

AVON
CONNECTICUT

PROPOSED WATERSHED AREA MAP

SEPTEMBER 26, 2018

REVISIONS:

PREPARED FOR:

TOWN OF AVON
60 WEST MAIN STREET
AVON, CT 06001

BSC GROUP
300 Winding Brook Drive
Glastonbury, Connecticut 06033
860 652 8227

SCALE: 1" = 40'

0 20 40 80 FEET

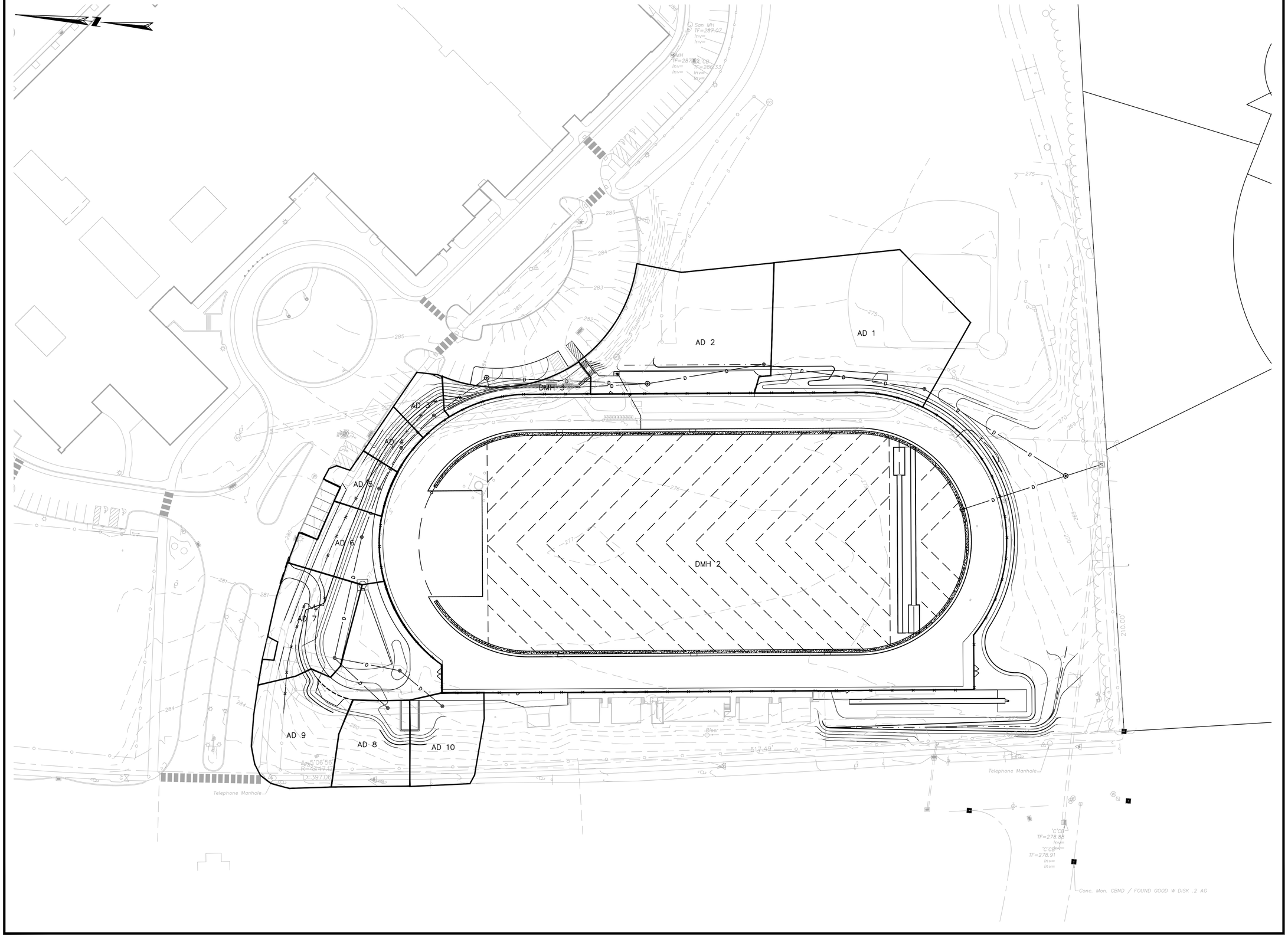
FILE: 8357202–PWAM.DWG

DWG. NO:

JOB. NO: 83572.02

FIGURE 3

FIGURE 4
Catchment Map



ATHLETIC FACILITY IMPROVEMENTS AT AVON HIGH SCHOOL

510 WEST AVON ROAD

IN

AVON
CONNECTICUT

CATHMENT AREA MAP

SEPTEMBER 26, 2018

REVISIONS:

PREPARED FOR:

TOWN OF AVON
60 WEST MAIN STREET
AVON, CT 06001

BSC GROUP
300 Winding Brook Drive
Glastonbury, Connecticut 06033
860 652 8227

SCALE: 1" = 40'

0 20 40 80 FEET

FILE: 8357202–CAM.DWG

DWG. NO:

JOB. NO: 83572.02

FIGURE 4

LIST OF APPENDICES

Appendix A - Existing Stormwater Discharge Computations

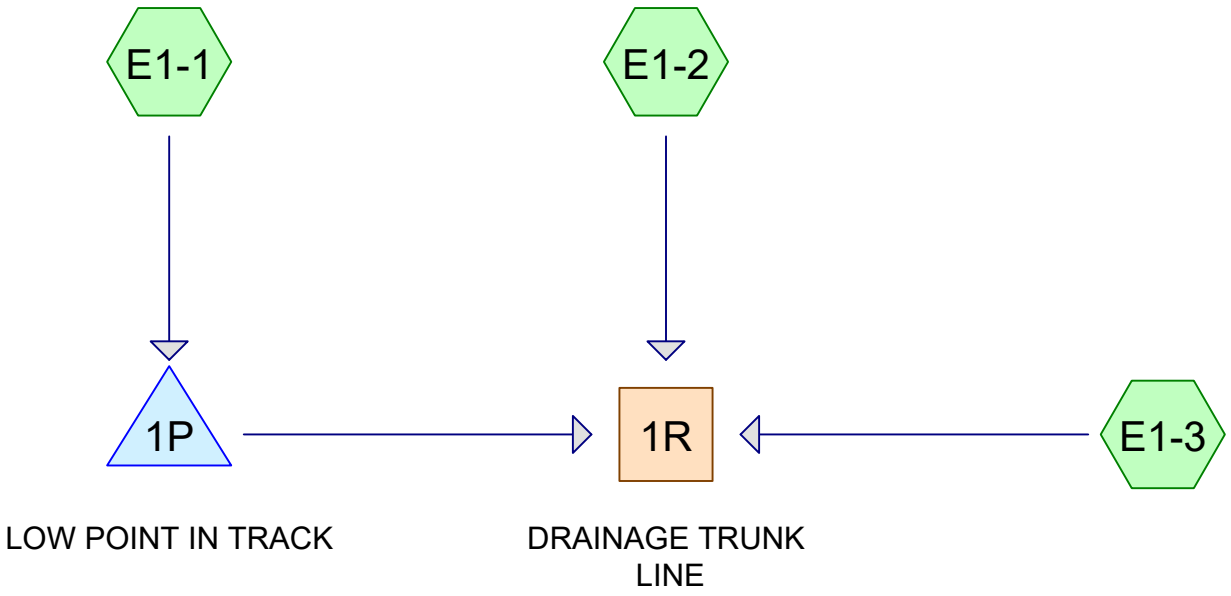
Appendix B - Proposed Stormwater Discharge Computations

Appendix C - Stormwater Drainage Sizing Computations

Appendix D – Water Quality Calculations

APPENDIX A

Existing Stormwater Discharge Computations



Subcat Reach Pond Link

Routing Diagram for 8357202-EWAM
Prepared by The BSC Group, Printed 10/2/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
8.140	80	>75% Grass cover, Good, HSG D (E1-1, E1-2, E1-3)
1.800	98	Paved parking, HSG D (E1-1, E1-2, E1-3)
9.940	**83**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
9.940	HSG D	E1-1, E1-2, E1-3
0.000	Other	
9.940		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	8.140	0.000	8.140	>75% Grass cover, Good	E1-1, E1-2, E1-3
0.000	0.000	0.000	1.800	0.000	1.800	Paved parking	E1-1, E1-2, E1-3
0.000	**0.000**	**0.000**	**9.940**	**0.000**	**9.940**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1-1: Runoff Area=4.350 ac 25.06% Impervious Runoff Depth>1.94"
Flow Length=615' Tc=16.2 min CN=85 Runoff=7.30 cfs 0.704 af

Subcatchment E1-2: Runoff Area=3.450 ac 4.06% Impervious Runoff Depth>1.64"
Flow Length=587' Tc=22.9 min CN=81 Runoff=4.20 cfs 0.470 af

Subcatchment E1-3: Runoff Area=2.140 ac 26.64% Impervious Runoff Depth>1.94"
Flow Length=874' Tc=15.4 min CN=85 Runoff=3.66 cfs 0.346 af

Reach 1R: DRAINAGE TRUNK LINE Inflow=14.65 cfs 1.483 af
Outflow=14.65 cfs 1.483 af

Pond 1P: LOW POINT IN TRACK Peak Elev=274.63' Storage=2,517 cf Inflow=7.30 cfs 0.704 af
Outflow=7.16 cfs 0.666 af

Total Runoff Area = 9.940 ac Runoff Volume = 1.520 af Average Runoff Depth = 1.83"
81.89% Pervious = 8.140 ac 18.11% Impervious = 1.800 ac

Summary for Subcatchment E1-1:

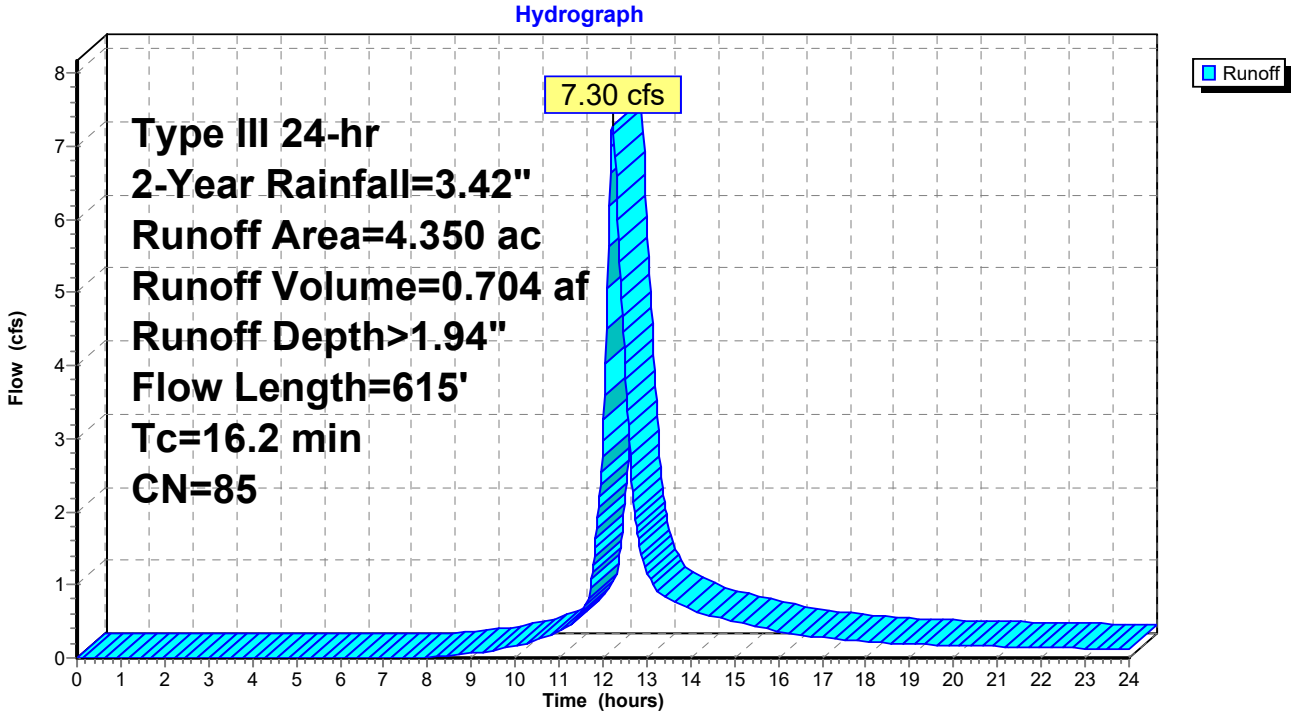
Runoff = 7.30 cfs @ 12.22 hrs, Volume= 0.704 af, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Rainfall=3.42"

Area (ac)	CN	Description
1.090	98	Paved parking, HSG D
3.260	80	>75% Grass cover, Good, HSG D
4.350	85	Weighted Average
3.260		74.94% Pervious Area
1.090		25.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	100	0.0500	0.17		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.20"
0.7	145	0.0300	3.52		**Shallow Concentrated Flow, SEG 2** Paved Kv= 20.3 fps
5.6	370	0.0046	1.09		**Shallow Concentrated Flow, SEG 3** Unpaved Kv= 16.1 fps
16.2	615	Total			

Subcatchment E1-1:



Summary for Subcatchment E1-2:

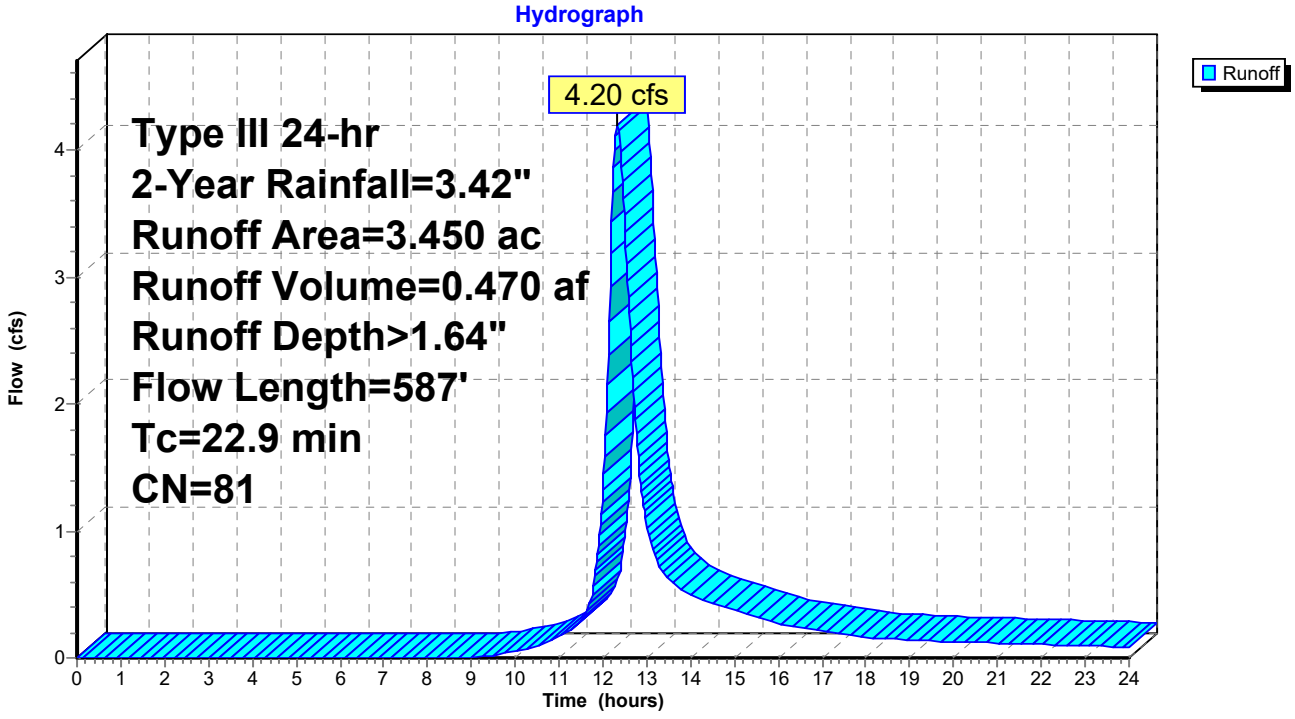
Runoff = 4.20 cfs @ 12.33 hrs, Volume= 0.470 af, Depth> 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Rainfall=3.42"

Area (ac)	CN	Description
0.140	98	Paved parking, HSG D
3.310	80	>75% Grass cover, Good, HSG D
3.450	81	Weighted Average
3.310		95.94% Pervious Area
0.140		4.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.8	100	0.0100	0.09		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.20"
4.1	487	0.0154	2.00		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
22.9	587	Total			

Subcatchment E1-2:



Summary for Subcatchment E1-3:

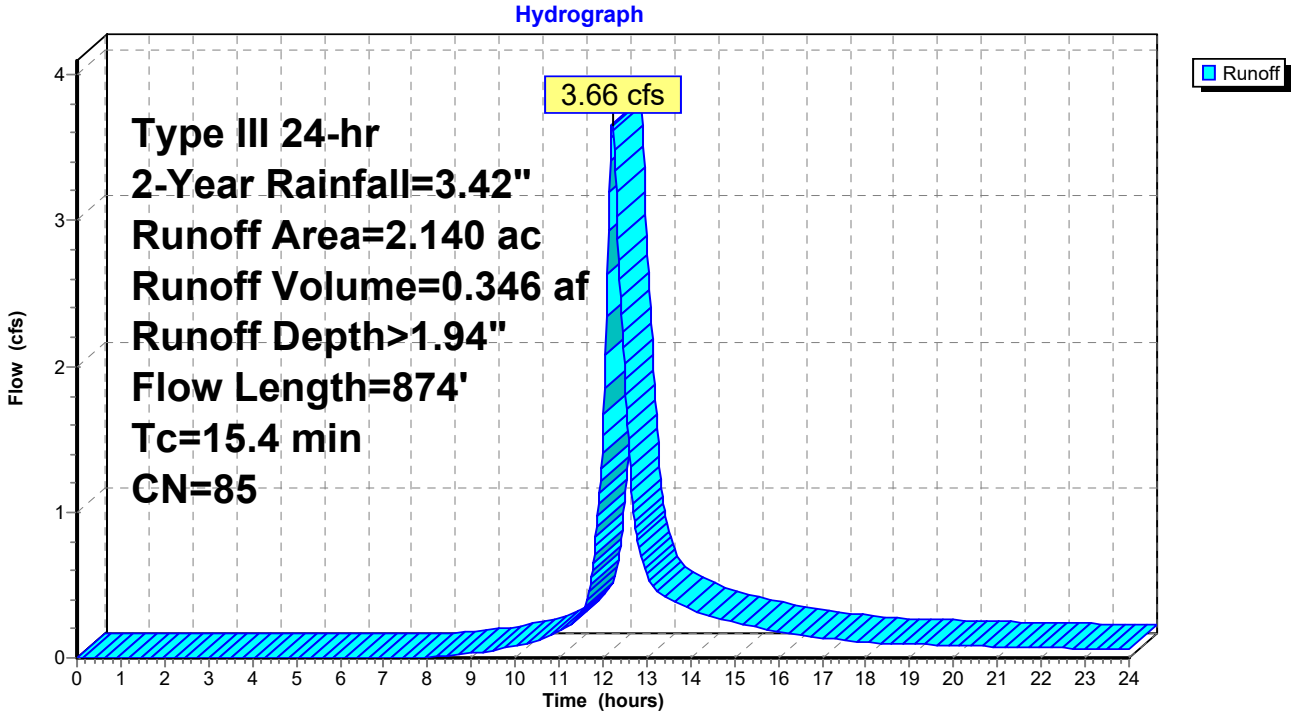
Runoff = 3.66 cfs @ 12.21 hrs, Volume= 0.346 af, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Rainfall=3.42"

Area (ac)	CN	Description
0.570	98	Paved parking, HSG D
1.570	80	>75% Grass cover, Good, HSG D
2.140	85	Weighted Average
1.570		73.36% Pervious Area
0.570		26.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0875	0.21		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.20"
7.5	774	0.0113	1.71		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
15.4	874	Total			

Subcatchment E1-3:



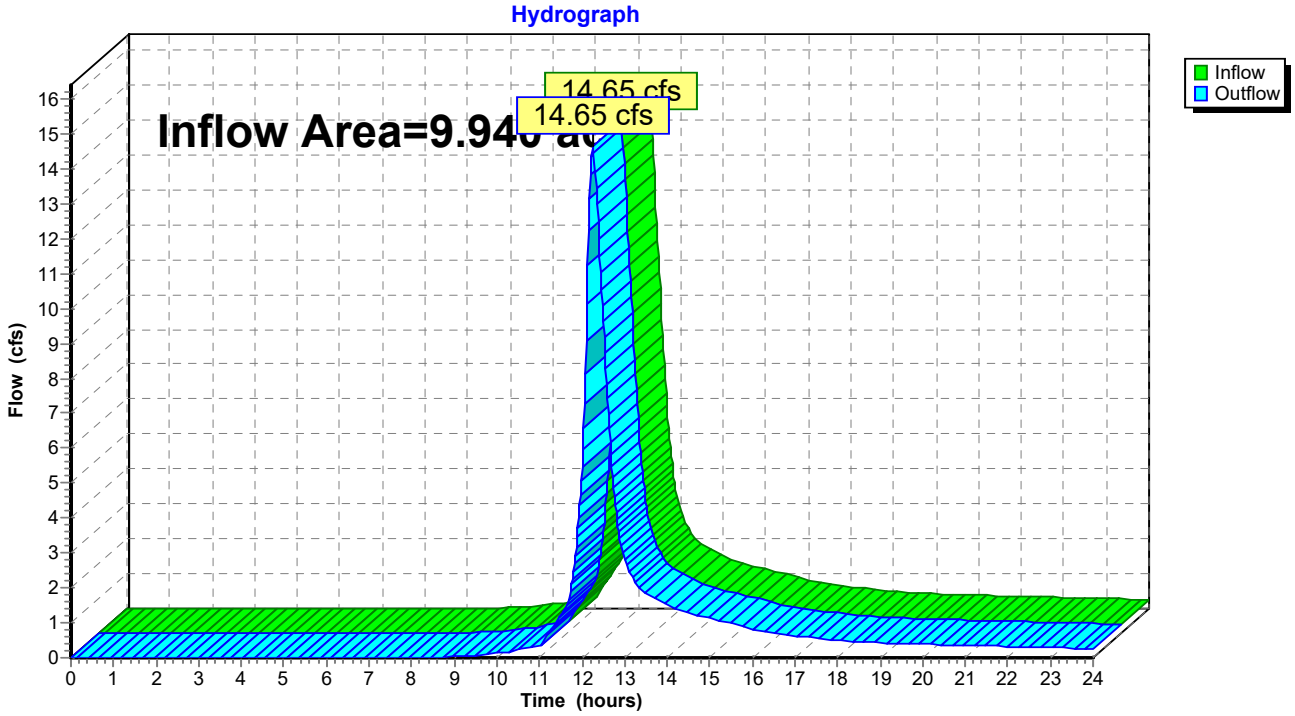
Summary for Reach 1R: DRAINAGE TRUNK LINE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 9.940 ac, 18.11% Impervious, Inflow Depth > 1.79" for 2-Year event
Inflow = 14.65 cfs @ 12.26 hrs, Volume= 1.483 af
Outflow = 14.65 cfs @ 12.26 hrs, Volume= 1.483 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach 1R: DRAINAGE TRUNK LINE



Summary for Pond 1P: LOW POINT IN TRACK

Inflow Area = 4.350 ac, 25.06% Impervious, Inflow Depth > 1.94" for 2-Year event
Inflow = 7.30 cfs @ 12.22 hrs, Volume= 0.704 af
Outflow = 7.16 cfs @ 12.25 hrs, Volume= 0.666 af, Atten= 2%, Lag= 1.8 min
Primary = 7.16 cfs @ 12.25 hrs, Volume= 0.666 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 274.63' @ 12.25 hrs Surf.Area= 17,251 sf Storage= 2,517 cf

Plug-Flow detention time= 42.6 min calculated for 0.666 af (95% of inflow)
Center-of-Mass det. time= 14.5 min (845.1 - 830.7)

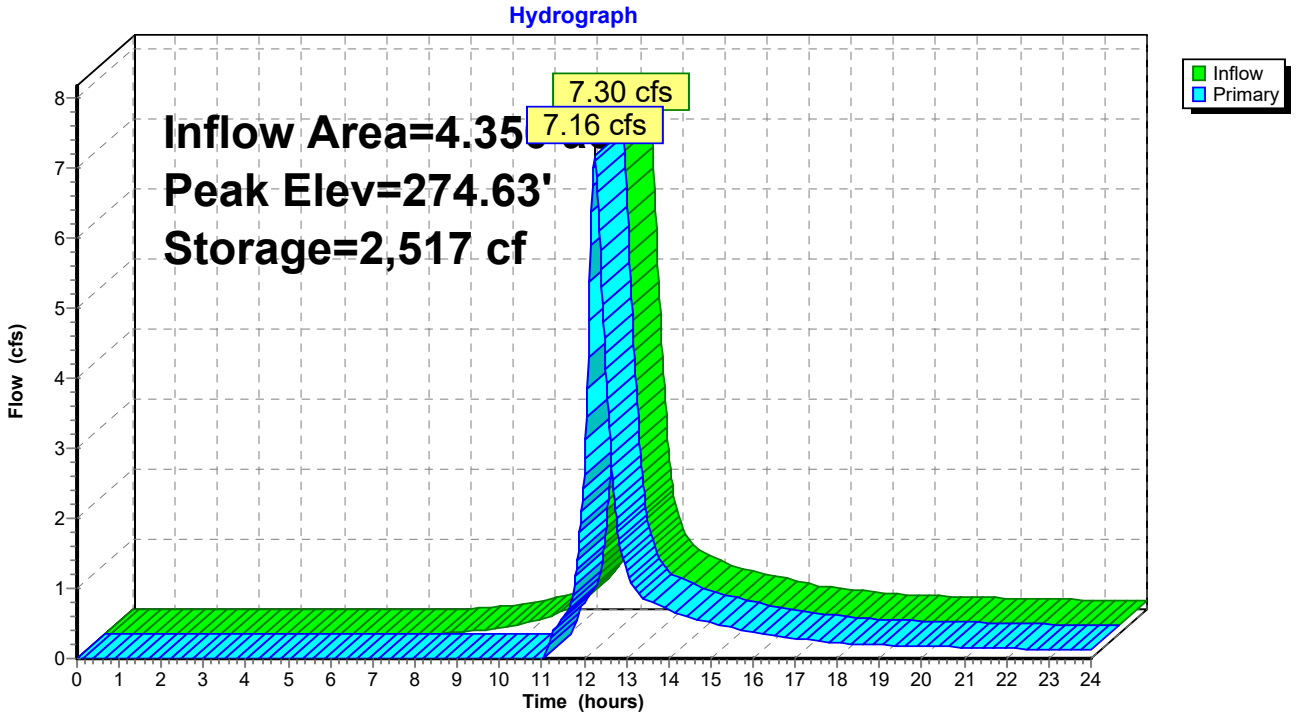
Volume	Invert	Avail.Storage	Storage Description
#1	274.30'	3,863 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
274.30	1,096	167.0	0	0	1,096
274.70	22,867	718.0	3,863	3,863	39,901

Device	Routing	Invert	Outlet Devices
#1	Primary	274.57'	**120.0' long (Profile 30) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.80 3.86 3.86

Primary OutFlow Max=7.15 cfs @ 12.25 hrs HW=274.63' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 7.15 cfs @ 0.95 fps)

Pond 1P: LOW POINT IN TRACK



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1-1: Runoff Area=4.350 ac 25.06% Impervious Runoff Depth>3.82"
Flow Length=615' Tc=16.2 min CN=85 Runoff=14.21 cfs 1.386 af

Subcatchment E1-2: Runoff Area=3.450 ac 4.06% Impervious Runoff Depth>3.42"
Flow Length=587' Tc=22.9 min CN=81 Runoff=8.81 cfs 0.982 af

Subcatchment E1-3: Runoff Area=2.140 ac 26.64% Impervious Runoff Depth>3.82"
Flow Length=874' Tc=15.4 min CN=85 Runoff=7.13 cfs 0.682 af

Reach 1R: DRAINAGE TRUNK LINE Inflow=29.23 cfs 3.011 af
Outflow=29.23 cfs 3.011 af

Pond 1P: LOW POINT IN TRACK Peak Elev=274.67' Storage=3,174 cf Inflow=14.21 cfs 1.386 af
Outflow=13.97 cfs 1.348 af

Total Runoff Area = 9.940 ac Runoff Volume = 3.049 af Average Runoff Depth = 3.68"
81.89% Pervious = 8.140 ac 18.11% Impervious = 1.800 ac

Summary for Subcatchment E1-1:

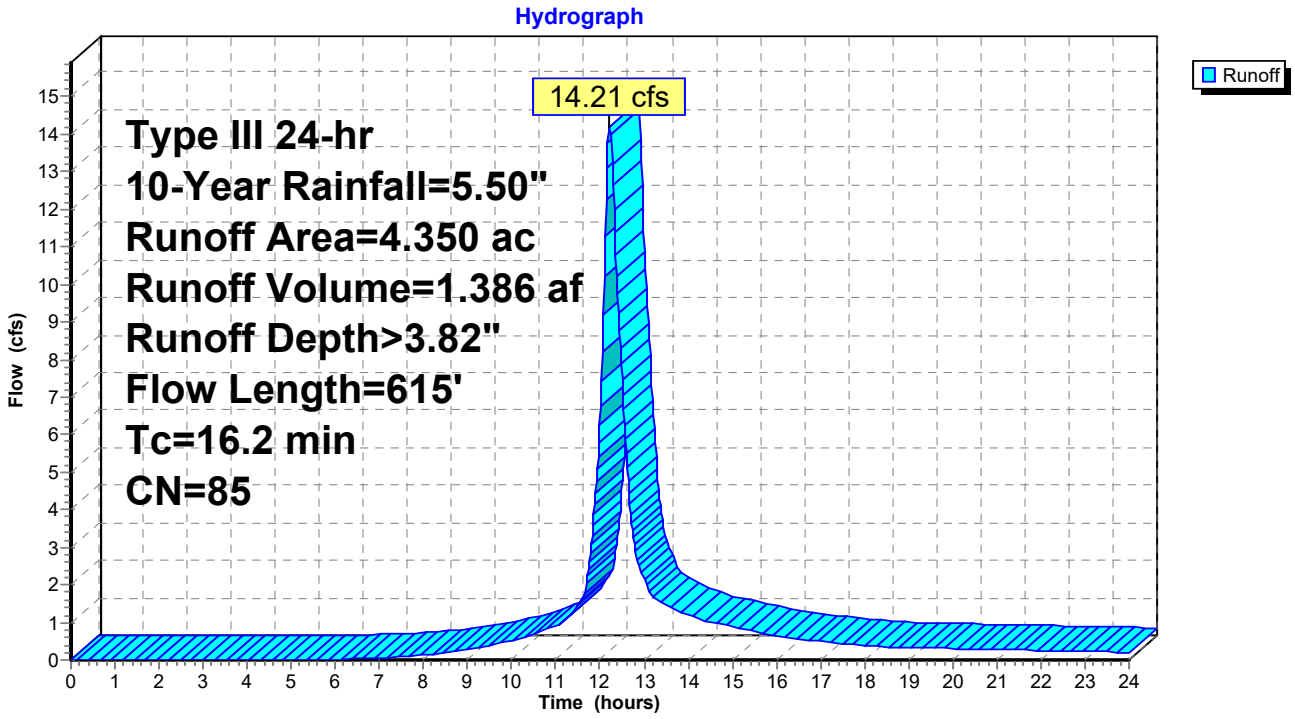
Runoff = 14.21 cfs @ 12.22 hrs, Volume= 1.386 af, Depth> 3.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Rainfall=5.50"

Area (ac)	CN	Description
1.090	98	Paved parking, HSG D
3.260	80	>75% Grass cover, Good, HSG D
4.350	85	Weighted Average
3.260		74.94% Pervious Area
1.090		25.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	100	0.0500	0.17		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.20"
0.7	145	0.0300	3.52		**Shallow Concentrated Flow, SEG 2** Paved Kv= 20.3 fps
5.6	370	0.0046	1.09		**Shallow Concentrated Flow, SEG 3** Unpaved Kv= 16.1 fps
16.2	615	Total			

Subcatchment E1-1:



Summary for Subcatchment E1-2:

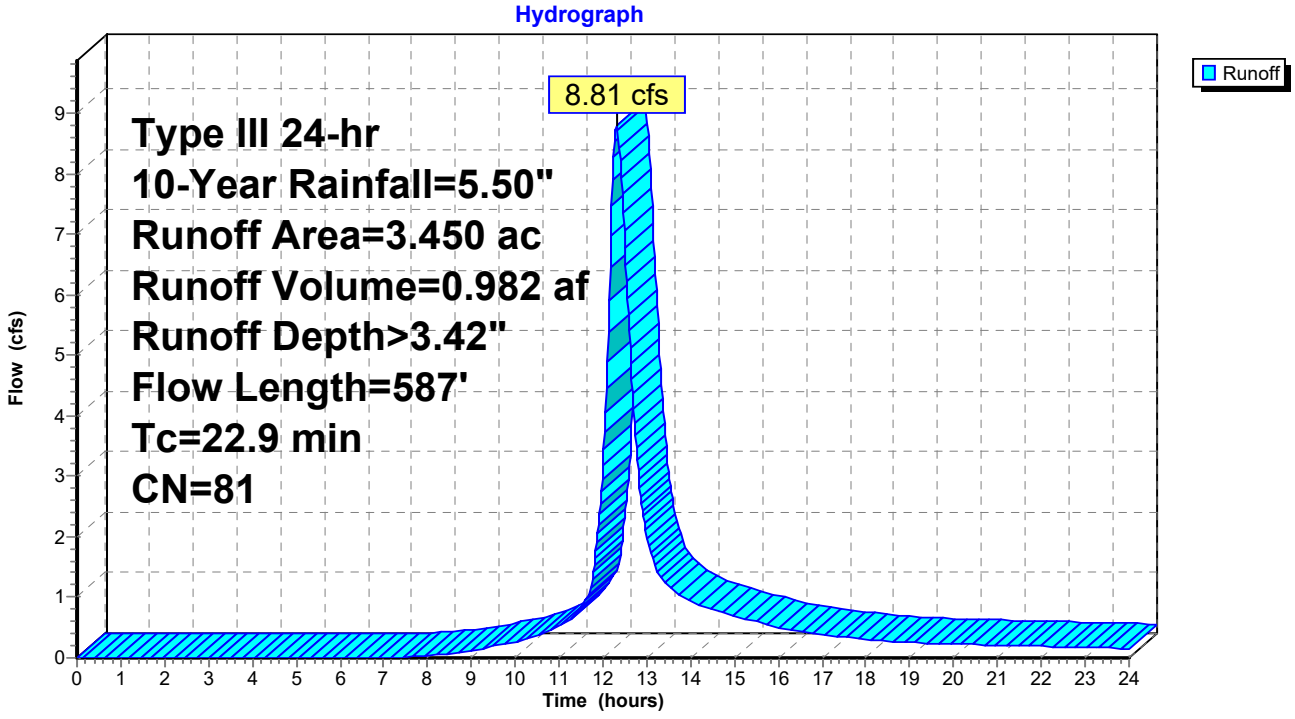
Runoff = 8.81 cfs @ 12.31 hrs, Volume= 0.982 af, Depth> 3.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Rainfall=5.50"

Area (ac)	CN	Description
0.140	98	Paved parking, HSG D
3.310	80	>75% Grass cover, Good, HSG D
3.450	81	Weighted Average
3.310		95.94% Pervious Area
0.140		4.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.8	100	0.0100	0.09		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.20"
4.1	487	0.0154	2.00		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
22.9	587	Total			

Subcatchment E1-2:



Summary for Subcatchment E1-3:

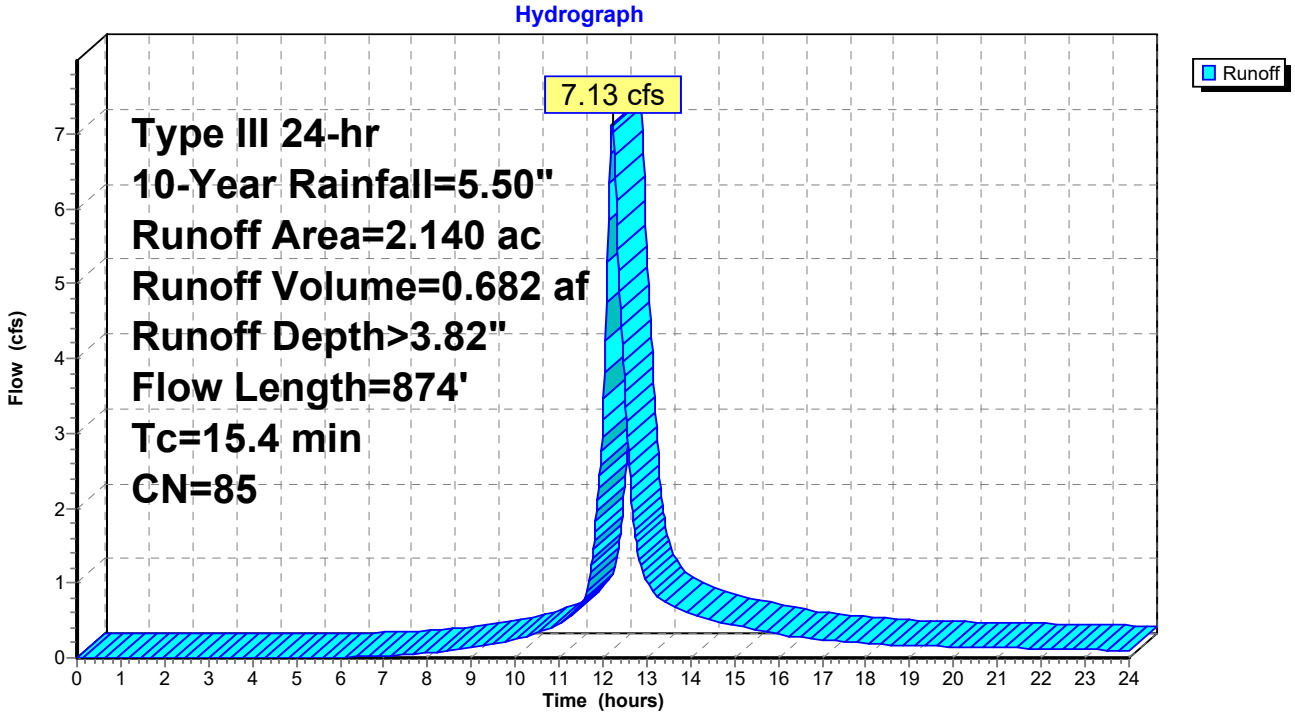
Runoff = 7.13 cfs @ 12.21 hrs, Volume= 0.682 af, Depth> 3.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Rainfall=5.50"

Area (ac)	CN	Description
0.570	98	Paved parking, HSG D
1.570	80	>75% Grass cover, Good, HSG D
2.140	85	Weighted Average
1.570		73.36% Pervious Area
0.570		26.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0875	0.21		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.20"
7.5	774	0.0113	1.71		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
15.4	874	Total			

Subcatchment E1-3:



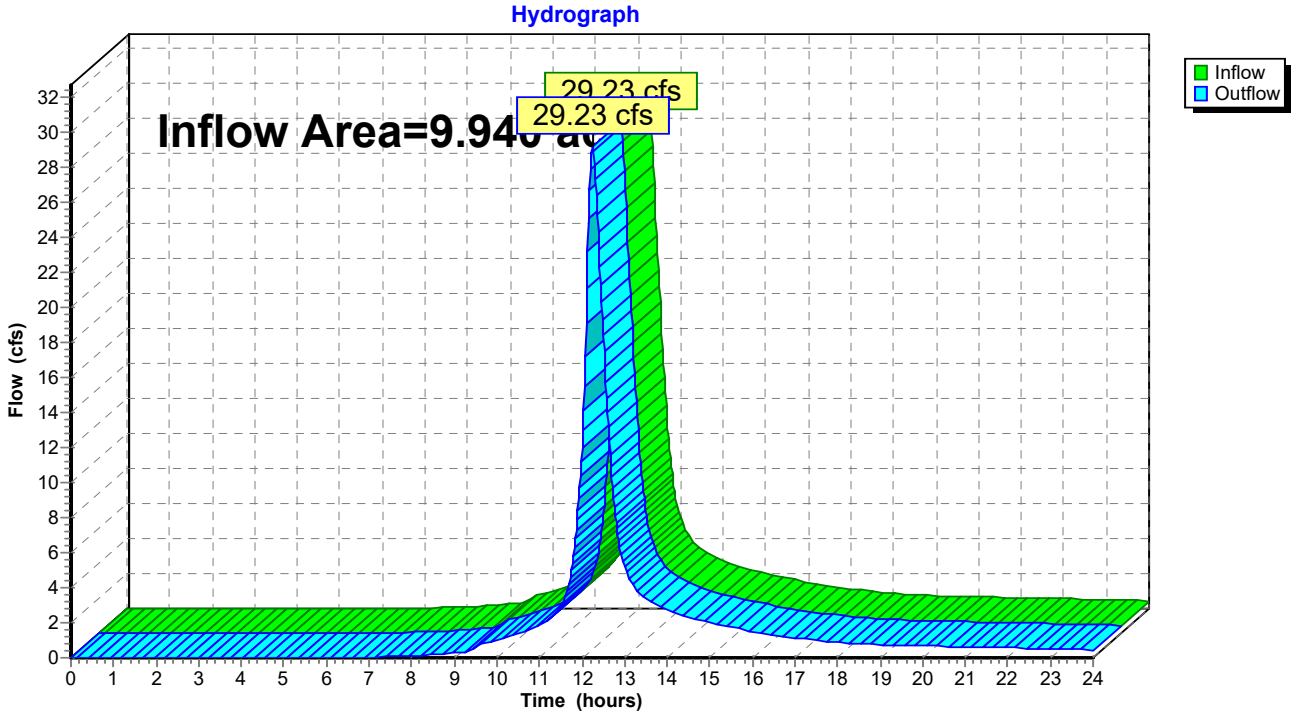
Summary for Reach 1R: DRAINAGE TRUNK LINE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 9.940 ac, 18.11% Impervious, Inflow Depth > 3.64" for 10-Year event
Inflow = 29.23 cfs @ 12.25 hrs, Volume= 3.011 af
Outflow = 29.23 cfs @ 12.25 hrs, Volume= 3.011 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach 1R: DRAINAGE TRUNK LINE



Summary for Pond 1P: LOW POINT IN TRACK

Inflow Area = 4.350 ac, 25.06% Impervious, Inflow Depth > 3.82" for 10-Year event
Inflow = 14.21 cfs @ 12.22 hrs, Volume= 1.386 af
Outflow = 13.97 cfs @ 12.24 hrs, Volume= 1.348 af, Atten= 2%, Lag= 1.6 min
Primary = 13.97 cfs @ 12.24 hrs, Volume= 1.348 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 274.67' @ 12.24 hrs Surf.Area= 20,093 sf Storage= 3,174 cf

Plug-Flow detention time= 26.5 min calculated for 1.346 af (97% of inflow)
Center-of-Mass det. time= 10.7 min (822.2 - 811.6)

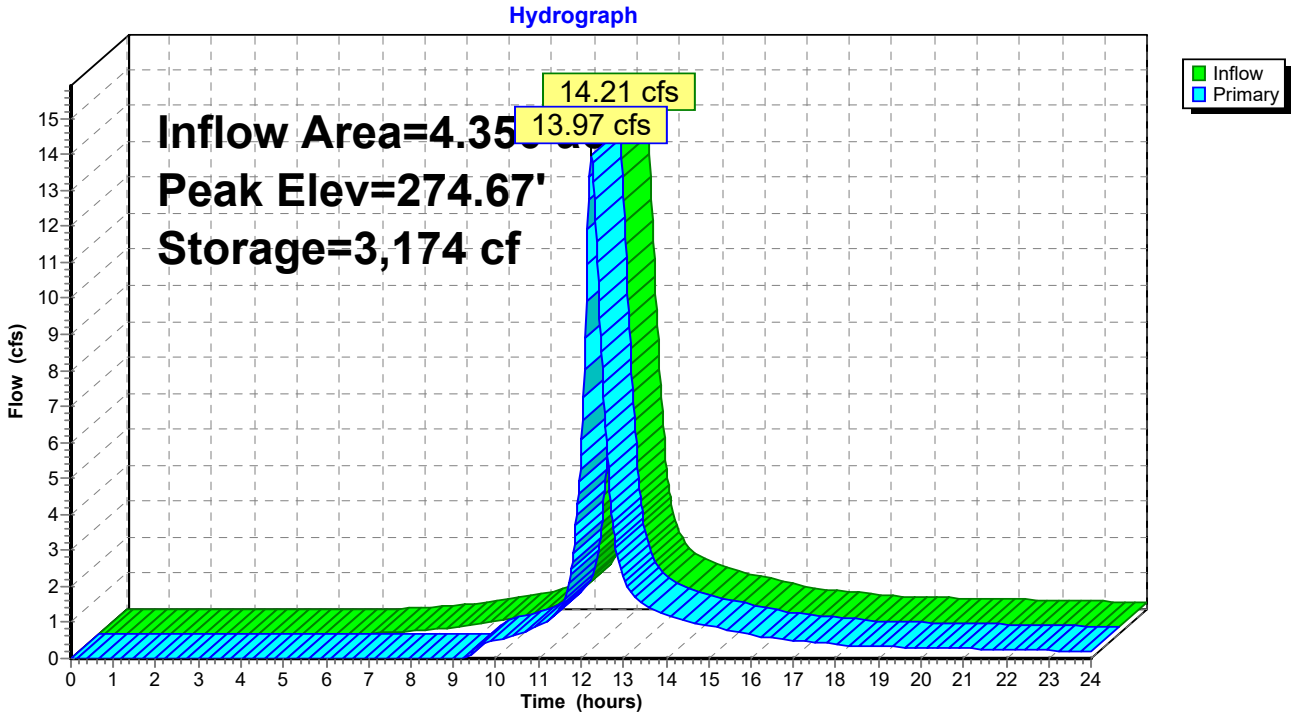
Volume	Invert	Avail.Storage	Storage Description
#1	274.30'	3,863 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
274.30	1,096	167.0	0	0	1,096
274.70	22,867	718.0	3,863	3,863	39,901

Device	Routing	Invert	Outlet Devices
#1	Primary	274.57'	**120.0' long (Profile 30) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.80 3.86 3.86

Primary OutFlow Max=13.95 cfs @ 12.24 hrs HW=274.67' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 13.95 cfs @ 1.19 fps)

Pond 1P: LOW POINT IN TRACK



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1-1: Runoff Area=4.350 ac 25.06% Impervious Runoff Depth>5.05"
Flow Length=615' Tc=16.2 min CN=85 Runoff=18.57 cfs 1.830 af

Subcatchment E1-2: Runoff Area=3.450 ac 4.06% Impervious Runoff Depth>4.60"
Flow Length=587' Tc=22.9 min CN=81 Runoff=11.80 cfs 1.323 af

Subcatchment E1-3: Runoff Area=2.140 ac 26.64% Impervious Runoff Depth>5.05"
Flow Length=874' Tc=15.4 min CN=85 Runoff=9.31 cfs 0.900 af

Reach 1R: DRAINAGE TRUNK LINE Inflow=38.50 cfs 4.015 af
Outflow=38.50 cfs 4.015 af

Pond 1P: LOW POINT IN TRACK Peak Elev=274.69' Storage=3,575 cf Inflow=18.57 cfs 1.830 af
Outflow=18.27 cfs 1.792 af

Total Runoff Area = 9.940 ac Runoff Volume = 4.053 af Average Runoff Depth = 4.89"
81.89% Pervious = 8.140 ac 18.11% Impervious = 1.800 ac

Summary for Subcatchment E1-1:

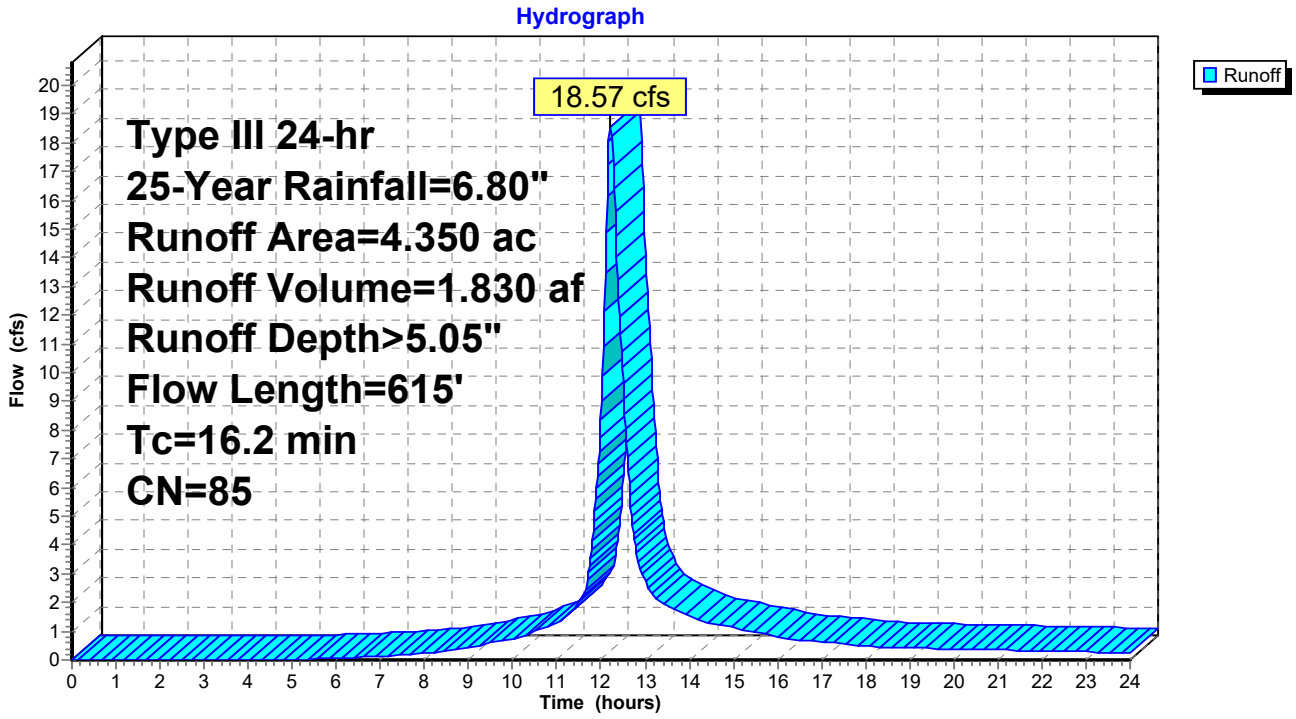
Runoff = 18.57 cfs @ 12.22 hrs, Volume= 1.830 af, Depth> 5.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Rainfall=6.80"

Area (ac)	CN	Description
1.090	98	Paved parking, HSG D
3.260	80	>75% Grass cover, Good, HSG D
4.350	85	Weighted Average
3.260		74.94% Pervious Area
1.090		25.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	100	0.0500	0.17		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.20"
0.7	145	0.0300	3.52		**Shallow Concentrated Flow, SEG 2** Paved Kv= 20.3 fps
5.6	370	0.0046	1.09		**Shallow Concentrated Flow, SEG 3** Unpaved Kv= 16.1 fps
16.2	615	Total			

Subcatchment E1-1:



Summary for Subcatchment E1-2:

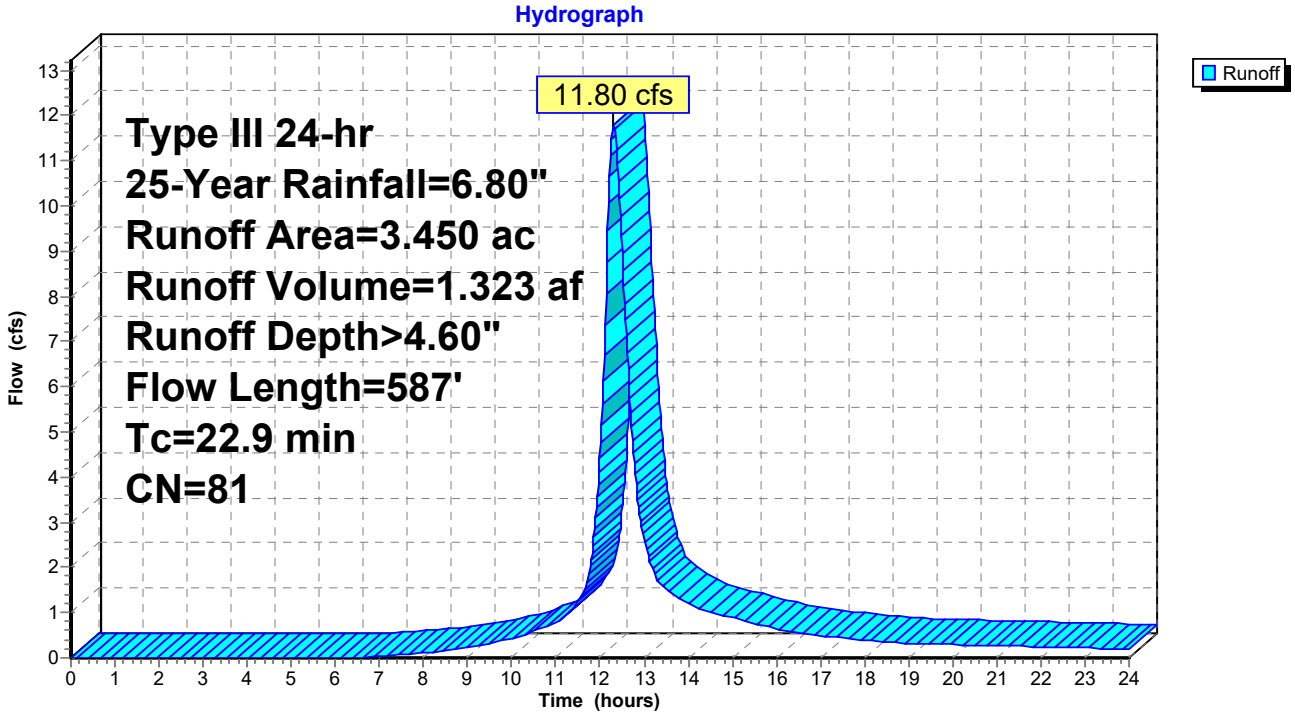
Runoff = 11.80 cfs @ 12.31 hrs, Volume= 1.323 af, Depth> 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Rainfall=6.80"

Area (ac)	CN	Description
0.140	98	Paved parking, HSG D
3.310	80	>75% Grass cover, Good, HSG D
3.450	81	Weighted Average
3.310		95.94% Pervious Area
0.140		4.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.8	100	0.0100	0.09		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.20"
4.1	487	0.0154	2.00		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
22.9	587	Total			

Subcatchment E1-2:



Summary for Subcatchment E1-3:

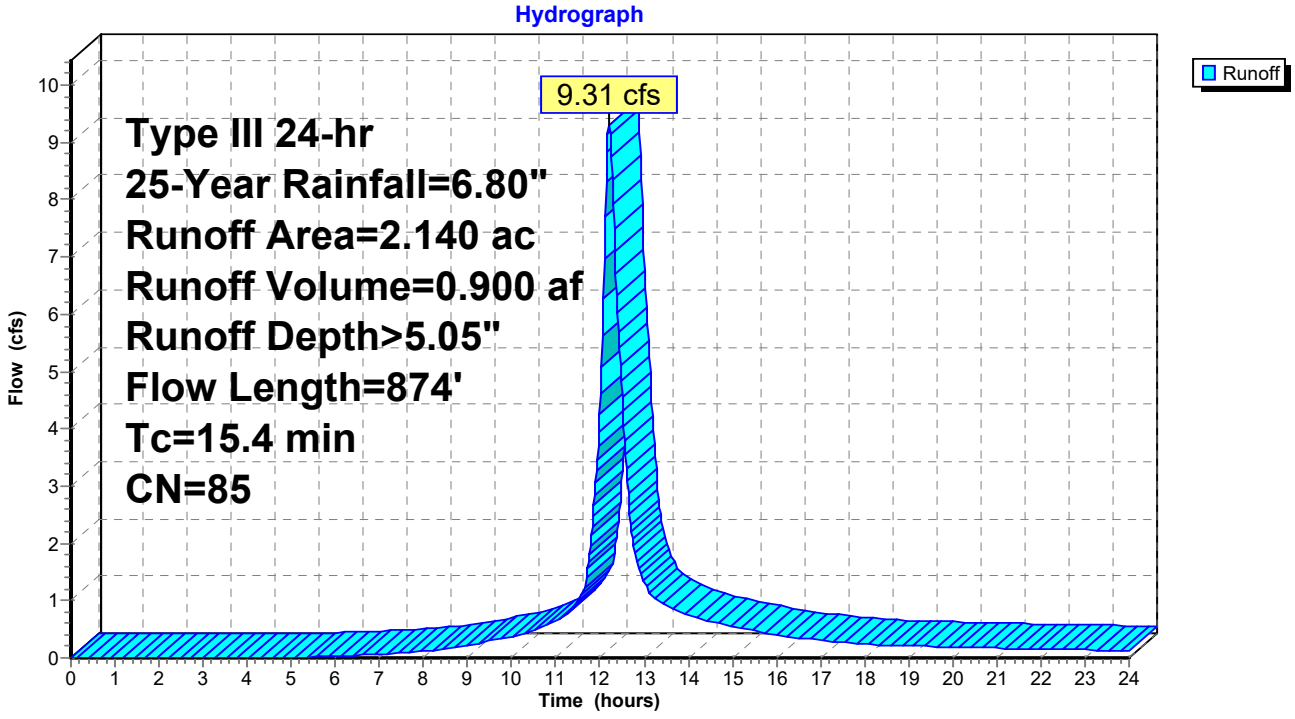
Runoff = 9.31 cfs @ 12.20 hrs, Volume= 0.900 af, Depth> 5.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Rainfall=6.80"

Area (ac)	CN	Description
0.570	98	Paved parking, HSG D
1.570	80	>75% Grass cover, Good, HSG D
2.140	85	Weighted Average
1.570		73.36% Pervious Area
0.570		26.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0875	0.21		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.20"
7.5	774	0.0113	1.71		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
15.4	874	Total			

Subcatchment E1-3:



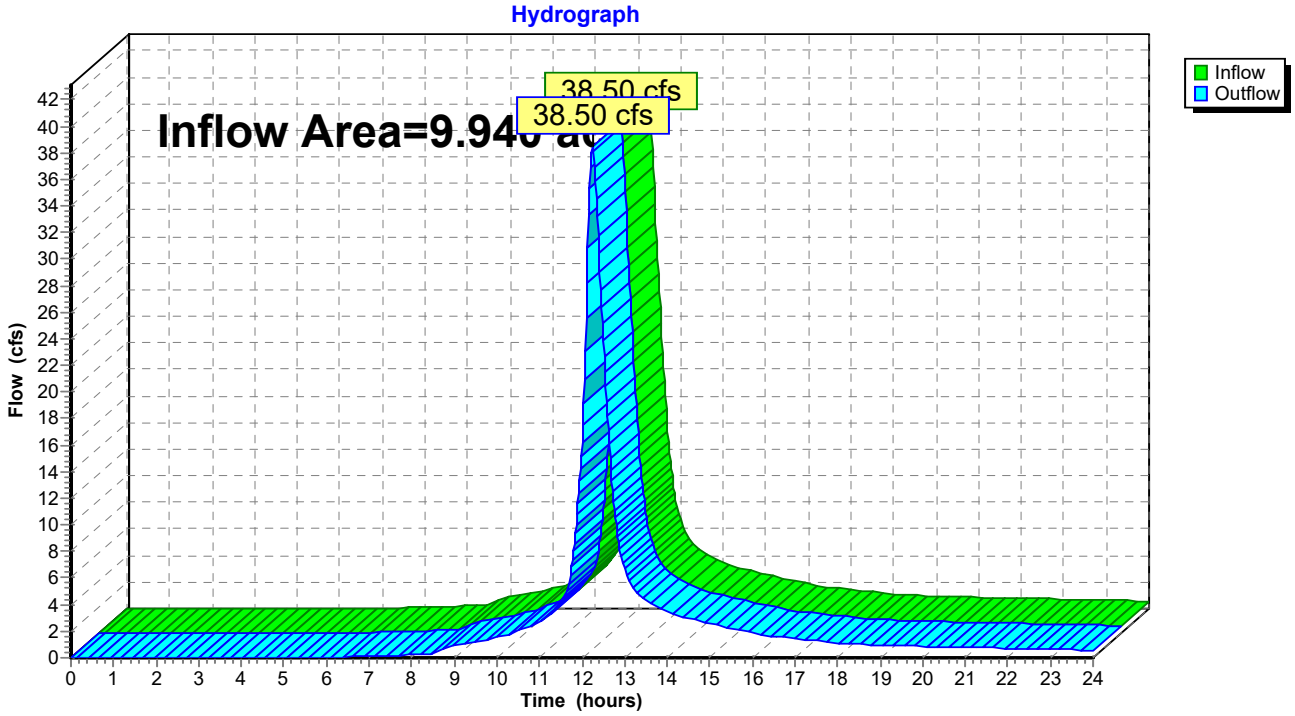
Summary for Reach 1R: DRAINAGE TRUNK LINE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 9.940 ac, 18.11% Impervious, Inflow Depth > 4.85" for 25-Year event
Inflow = 38.50 cfs @ 12.25 hrs, Volume= 4.015 af
Outflow = 38.50 cfs @ 12.25 hrs, Volume= 4.015 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach 1R: DRAINAGE TRUNK LINE



Summary for Pond 1P: LOW POINT IN TRACK

Inflow Area = 4.350 ac, 25.06% Impervious, Inflow Depth > 5.05" for 25-Year event
Inflow = 18.57 cfs @ 12.22 hrs, Volume= 1.830 af
Outflow = 18.27 cfs @ 12.24 hrs, Volume= 1.792 af, Atten= 2%, Lag= 1.6 min
Primary = 18.27 cfs @ 12.24 hrs, Volume= 1.792 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 274.69' @ 12.24 hrs Surf.Area= 21,729 sf Storage= 3,575 cf

Plug-Flow detention time= 21.9 min calculated for 1.792 af (98% of inflow)
Center-of-Mass det. time= 9.5 min (813.3 - 803.8)

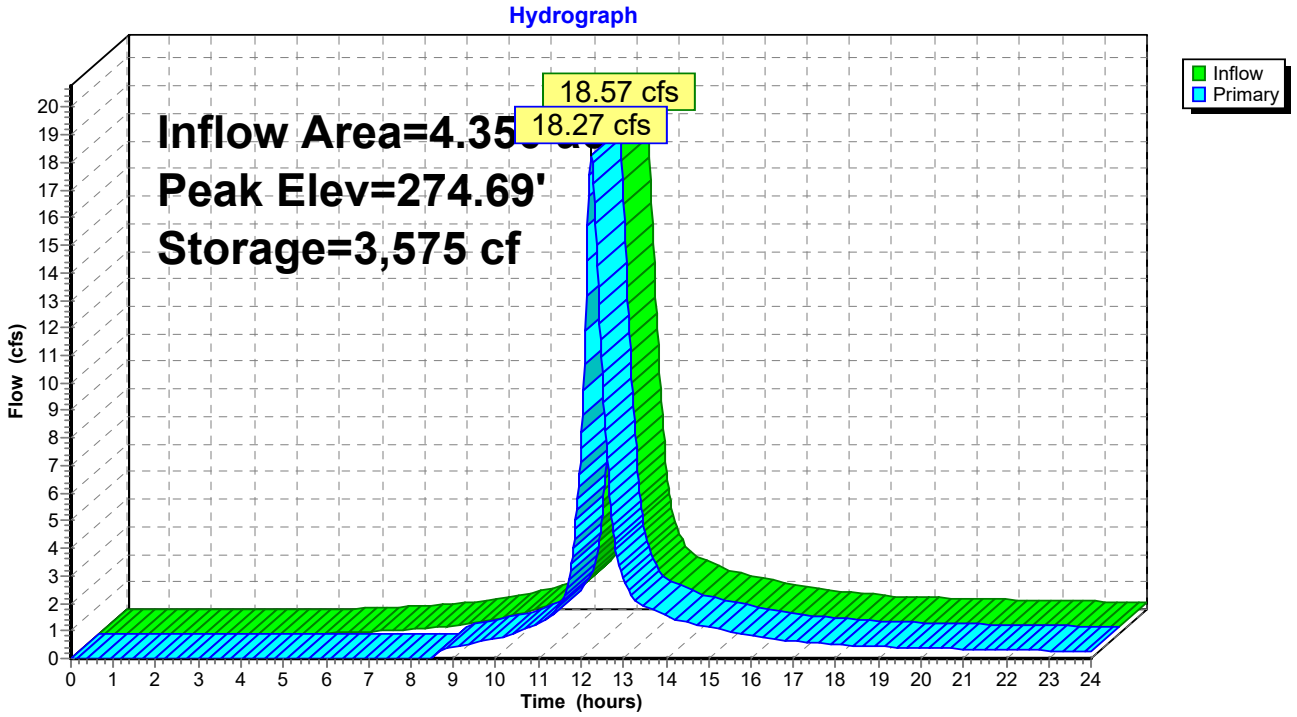
Volume	Invert	Avail.Storage	Storage Description
#1	274.30'	3,863 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
274.30	1,096	167.0	0	0	1,096
274.70	22,867	718.0	3,863	3,863	39,901

Device	Routing	Invert	Outlet Devices
#1	Primary	274.57'	**120.0' long (Profile 30) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.80 3.86 3.86

Primary OutFlow Max=18.25 cfs @ 12.24 hrs HW=274.69' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 18.25 cfs @ 1.30 fps)

Pond 1P: LOW POINT IN TRACK



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1-1: Runoff Area=4.350 ac 25.06% Impervious Runoff Depth>6.98"
Flow Length=615' Tc=16.2 min CN=85 Runoff=25.28 cfs 2.530 af

Subcatchment E1-2: Runoff Area=3.450 ac 4.06% Impervious Runoff Depth>6.48"
Flow Length=587' Tc=22.9 min CN=81 Runoff=16.45 cfs 1.864 af

Subcatchment E1-3: Runoff Area=2.140 ac 26.64% Impervious Runoff Depth>6.98"
Flow Length=874' Tc=15.4 min CN=85 Runoff=12.68 cfs 1.245 af

Reach 1R: DRAINAGE TRUNK LINE Inflow=51.76 cfs 5.587 af
Outflow=51.76 cfs 5.587 af

Pond 1P: LOW POINT IN TRACK Peak Elev=274.71' Storage=3,863 cf Inflow=25.28 cfs 2.530 af
Outflow=24.12 cfs 2.478 af

Total Runoff Area = 9.940 ac Runoff Volume = 5.639 af Average Runoff Depth = 6.81"
81.89% Pervious = 8.140 ac 18.11% Impervious = 1.800 ac

Summary for Subcatchment E1-1:

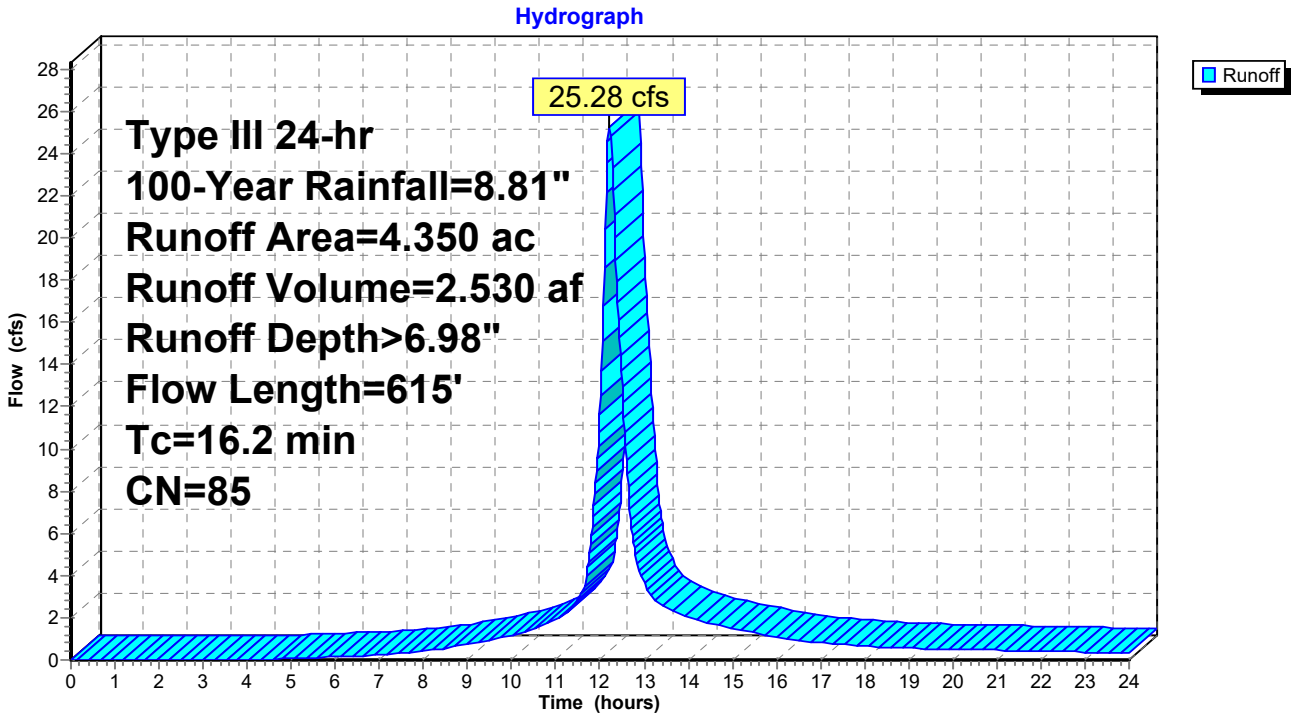
Runoff = 25.28 cfs @ 12.21 hrs, Volume= 2.530 af, Depth> 6.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=8.81"

Area (ac)	CN	Description
1.090	98	Paved parking, HSG D
3.260	80	>75% Grass cover, Good, HSG D
4.350	85	Weighted Average
3.260		74.94% Pervious Area
1.090		25.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	100	0.0500	0.17		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.20"
0.7	145	0.0300	3.52		**Shallow Concentrated Flow, SEG 2** Paved Kv= 20.3 fps
5.6	370	0.0046	1.09		**Shallow Concentrated Flow, SEG 3** Unpaved Kv= 16.1 fps
16.2	615	Total			

Subcatchment E1-1:



Summary for Subcatchment E1-2:

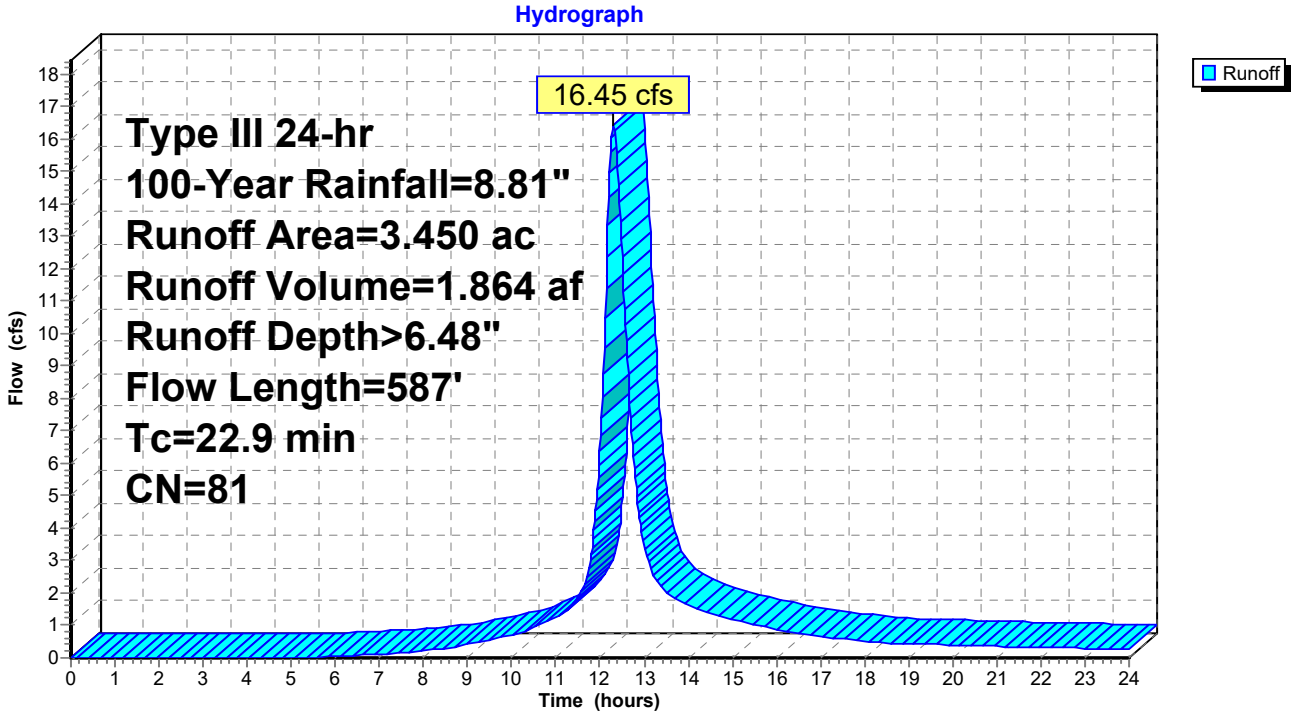
Runoff = 16.45 cfs @ 12.30 hrs, Volume= 1.864 af, Depth> 6.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=8.81"

Area (ac)	CN	Description
0.140	98	Paved parking, HSG D
3.310	80	>75% Grass cover, Good, HSG D
3.450	81	Weighted Average
3.310		95.94% Pervious Area
0.140		4.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.8	100	0.0100	0.09		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.20"
4.1	487	0.0154	2.00		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
22.9	587	Total			

Subcatchment E1-2:



Summary for Subcatchment E1-3:

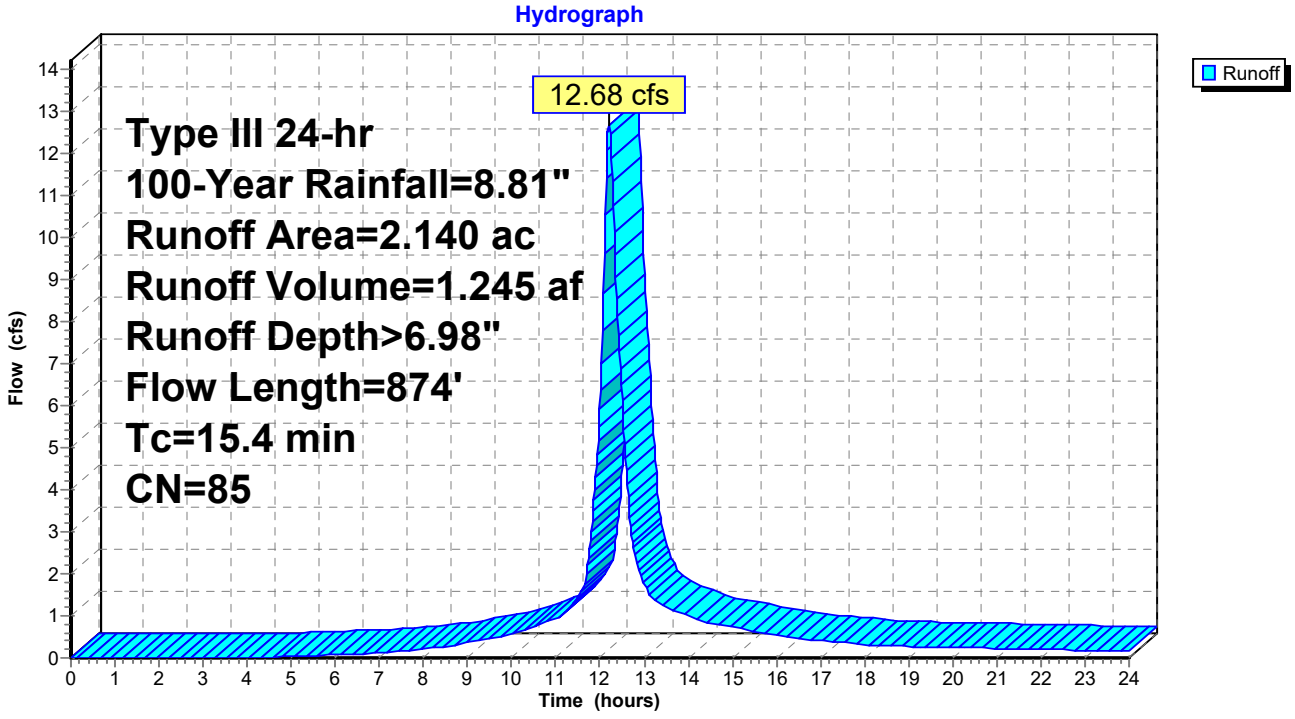
Runoff = 12.68 cfs @ 12.20 hrs, Volume= 1.245 af, Depth> 6.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=8.81"

Area (ac)	CN	Description
0.570	98	Paved parking, HSG D
1.570	80	>75% Grass cover, Good, HSG D
2.140	85	Weighted Average
1.570		73.36% Pervious Area
0.570		26.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0875	0.21		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.20"
7.5	774	0.0113	1.71		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
15.4	874	Total			

Subcatchment E1-3:



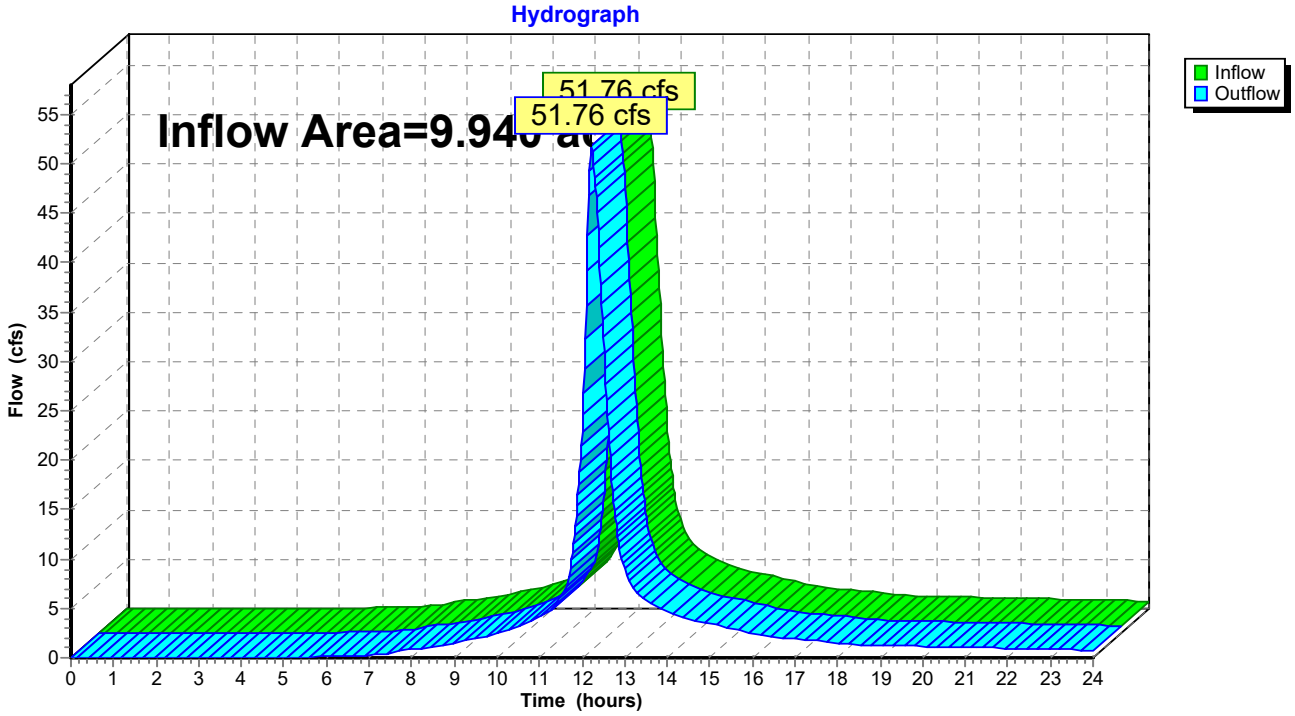
Summary for Reach 1R: DRAINAGE TRUNK LINE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 9.940 ac, 18.11% Impervious, Inflow Depth > 6.74" for 100-Year event
Inflow = 51.76 cfs @ 12.23 hrs, Volume= 5.587 af
Outflow = 51.76 cfs @ 12.23 hrs, Volume= 5.587 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach 1R: DRAINAGE TRUNK LINE



Summary for Pond 1P: LOW POINT IN TRACK

[93] Warning: Storage range exceeded by 0.01'

Inflow Area = 4.350 ac, 25.06% Impervious, Inflow Depth > 6.98" for 100-Year event
Inflow = 25.28 cfs @ 12.21 hrs, Volume= 2.530 af
Outflow = 24.12 cfs @ 12.21 hrs, Volume= 2.478 af, Atten= 5%, Lag= 0.0 min
Primary = 24.12 cfs @ 12.21 hrs, Volume= 2.478 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 274.71' @ 12.21 hrs Surf.Area= 22,867 sf Storage= 3,863 cf

Plug-Flow detention time= 20.9 min calculated for 2.475 af (98% of inflow)
Center-of-Mass det. time= 8.5 min (803.6 - 795.0)

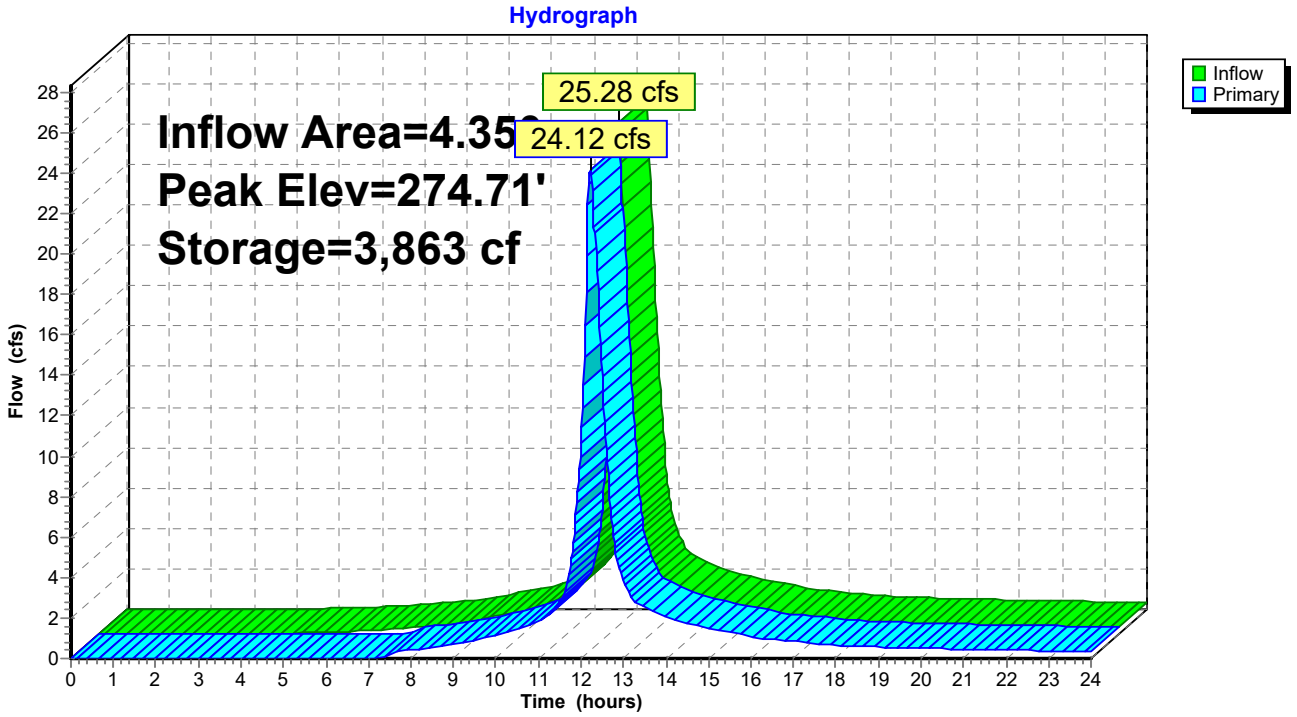
Volume	Invert	Avail.Storage	Storage Description
#1	274.30'	3,863 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
274.30	1,096	167.0	0	0	1,096
274.70	22,867	718.0	3,863	3,863	39,901

Device	Routing	Invert	Outlet Devices
#1	Primary	274.57'	**120.0' long (Profile 30) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 Coef. (English) 3.80 3.86 3.86

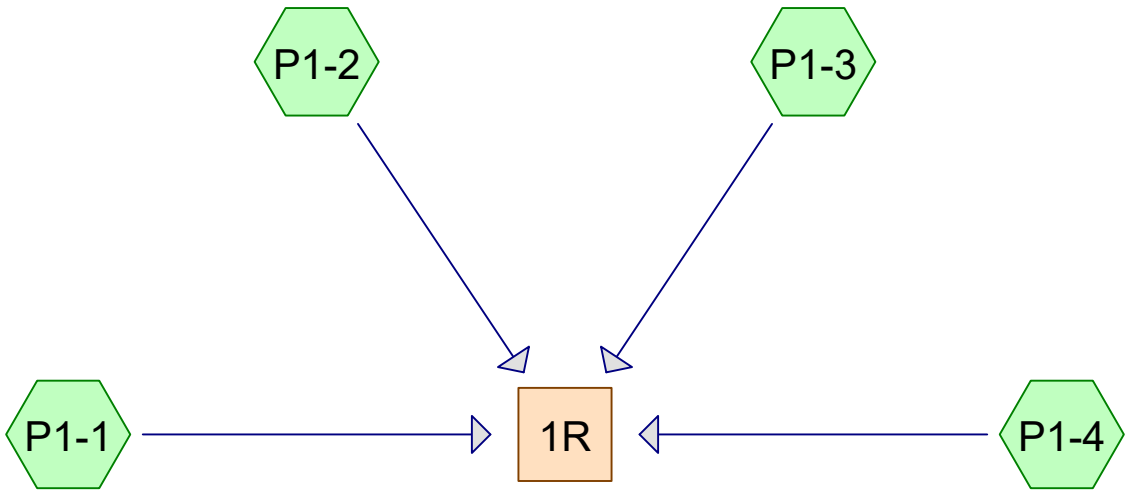
Primary OutFlow Max=24.07 cfs @ 12.21 hrs HW=274.71' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 24.07 cfs @ 1.43 fps)

Pond 1P: LOW POINT IN TRACK



APPENDIX B

Proposed Stormwater Discharge Computations



DRAINAGE TRUNK
LINE

Subcat Reach Pond Link

Routing Diagram for 8357202-PWAM
Prepared by The BSC Group, Printed 10/2/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.190	80	>75% Grass cover, Good, HSG D (P1-2, P1-3, P1-4)
1.260	98	Paved parking, HSG D (P1-2, P1-3, P1-4)
3.500	98	Turf (P1-1)
9.950	**89**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
6.450	HSG D	P1-2, P1-3, P1-4
3.500	Other	P1-1
9.950		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	5.190	0.000	5.190	>75% Grass cover, Good	P1-2, P1-3, P1-4
0.000	0.000	0.000	1.260	0.000	1.260	Paved parking	P1-2, P1-3, P1-4
0.000	0.000	0.000	0.000	3.500	3.500	Turf	P1-1
0.000	**0.000**	**0.000**	**6.450**	**3.500**	**9.950**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1-1: Runoff Area=3.500 ac 100.00% Impervious Runoff Depth>2.87"
Tc=366.0 min CN=98 Runoff=1.41 cfs 0.837 af

Subcatchment P1-2: Runoff Area=2.340 ac 29.06% Impervious Runoff Depth>1.94"
Flow Length=170' Tc=18.7 min CN=85 Runoff=3.70 cfs 0.378 af

Subcatchment P1-3: Runoff Area=2.250 ac 3.11% Impervious Runoff Depth>1.64"
Flow Length=587' Tc=22.3 min CN=81 Runoff=2.78 cfs 0.307 af

Subcatchment P1-4: Runoff Area=1.860 ac 27.42% Impervious Runoff Depth>1.94"
Flow Length=843' Tc=15.3 min CN=85 Runoff=3.19 cfs 0.301 af

Reach 1R: DRAINAGE TRUNK LINE Inflow=9.66 cfs 1.823 af
Outflow=9.66 cfs 1.823 af

Total Runoff Area = 9.950 ac Runoff Volume = 1.823 af Average Runoff Depth = 2.20"
52.16% Pervious = 5.190 ac 47.84% Impervious = 4.760 ac

Summary for Subcatchment P1-1:

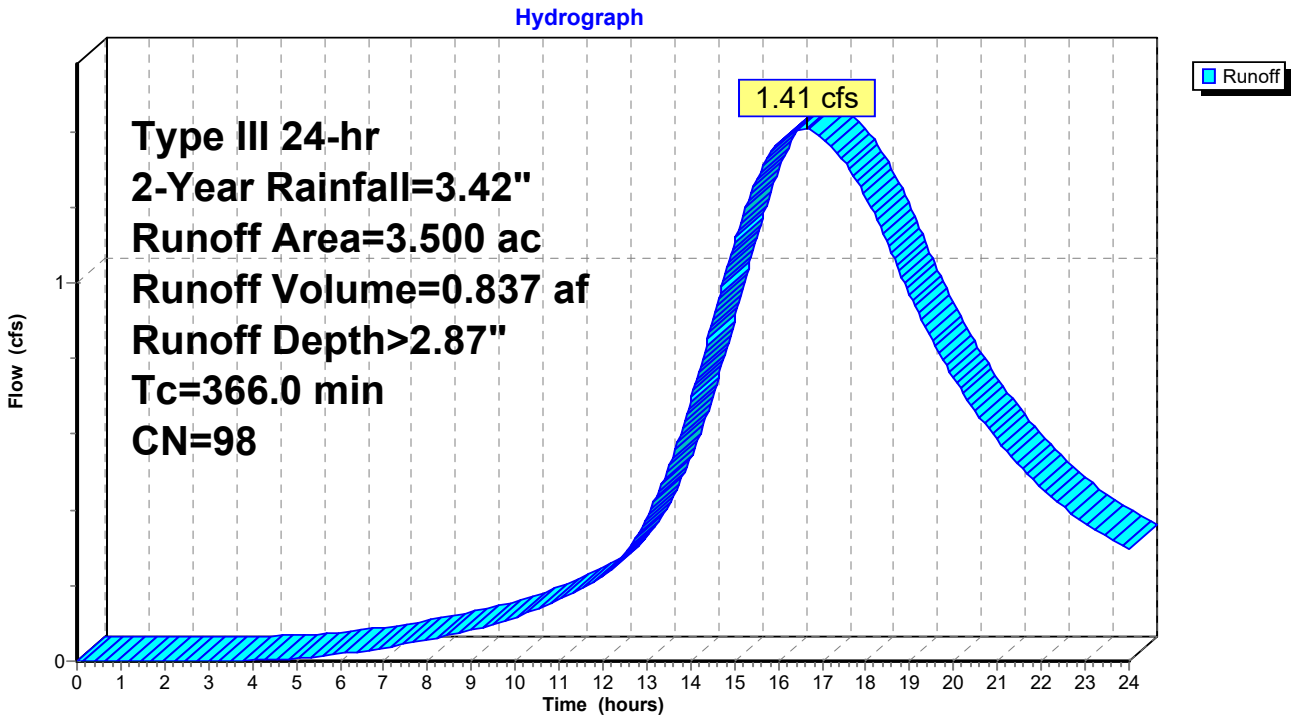
Runoff = 1.41 cfs @ 16.67 hrs, Volume= 0.837 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Rainfall=3.42"

	Area (ac)	CN	Description
*	3.500	98	Turf
	3.500		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Time to pond**
360.0					**Direct Entry, Time to reach flat panel**
366.0	0	Total			

Subcatchment P1-1:



Summary for Subcatchment P1-2:

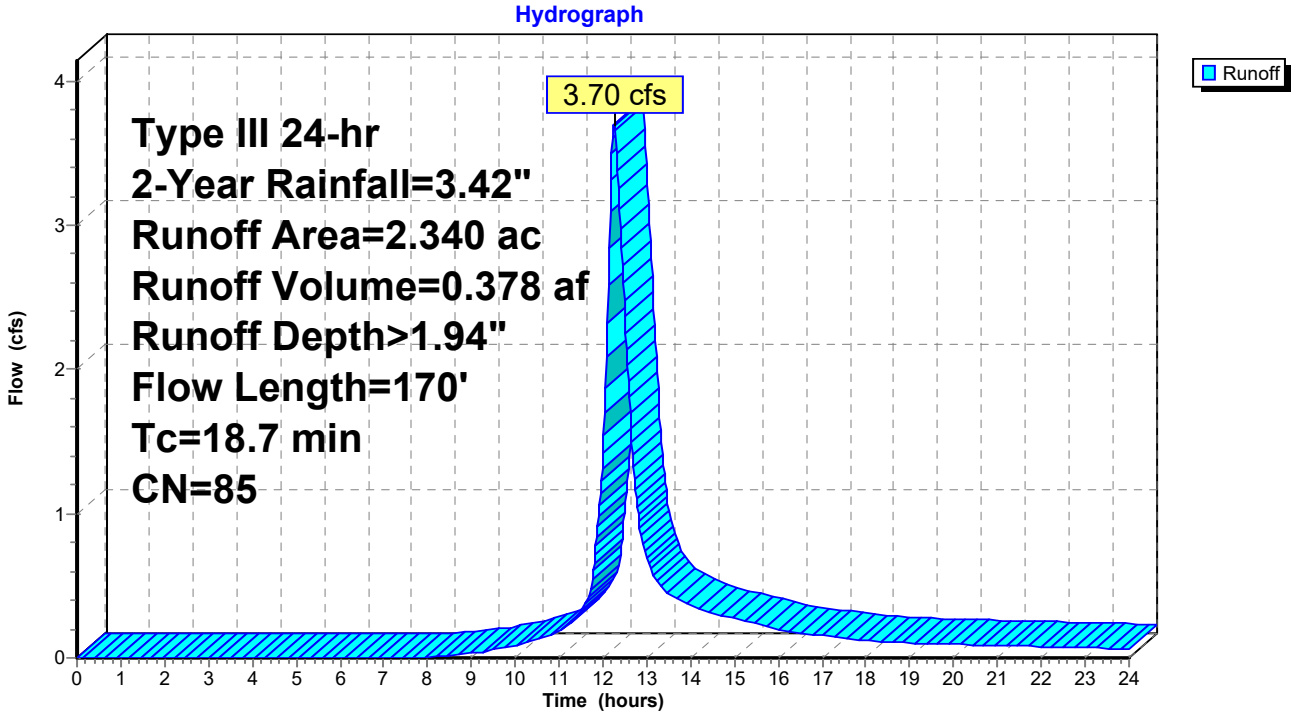
Runoff = 3.70 cfs @ 12.26 hrs, Volume= 0.378 af, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Rainfall=3.42"

Area (ac)	CN	Description
0.680	98	Paved parking, HSG D
1.660	80	>75% Grass cover, Good, HSG D
2.340	85	Weighted Average
1.660		70.94% Pervious Area
0.680		29.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.0100	0.09		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.42"
0.5	70	0.0179	2.15		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
18.7	170	Total			

Subcatchment P1-2:



Summary for Subcatchment P1-3:

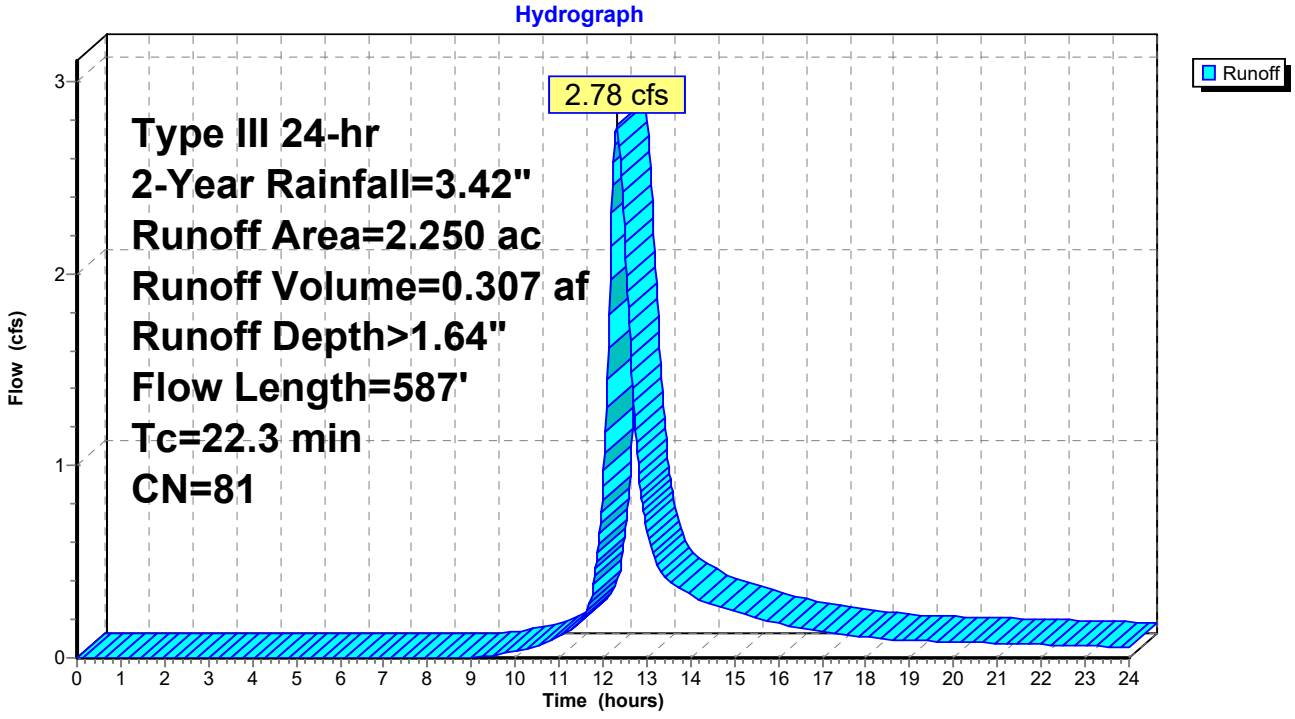
Runoff = 2.78 cfs @ 12.32 hrs, Volume= 0.307 af, Depth> 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Rainfall=3.42"

Area (ac)	CN	Description
0.070	98	Paved parking, HSG D
2.180	80	>75% Grass cover, Good, HSG D
2.250	81	Weighted Average
2.180		96.89% Pervious Area
0.070		3.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.0100	0.09		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.42"
4.1	487	0.0154	2.00		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
22.3	587	Total			

Subcatchment P1-3:



Summary for Subcatchment P1-4:

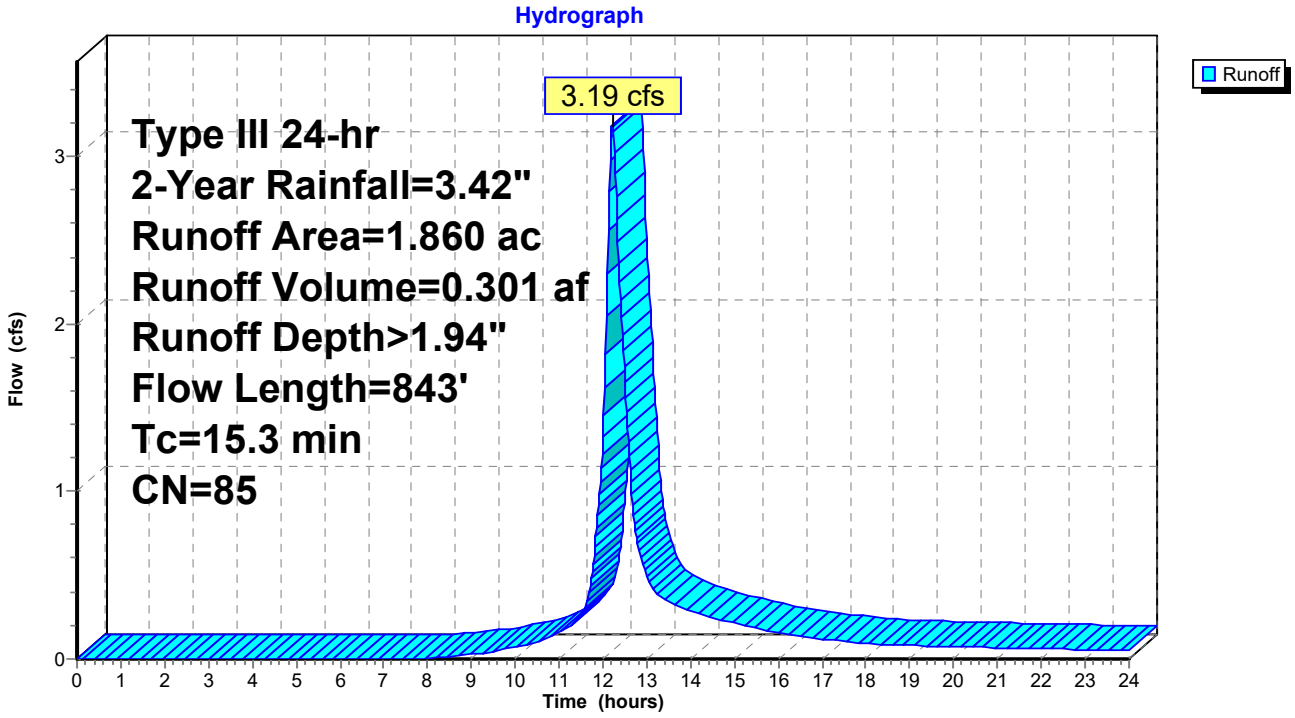
Runoff = 3.19 cfs @ 12.21 hrs, Volume= 0.301 af, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Year Rainfall=3.42"

Area (ac)	CN	Description
0.510	98	Paved parking, HSG D
1.350	80	>75% Grass cover, Good, HSG D
1.860	85	Weighted Average
1.350		72.58% Pervious Area
0.510		27.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	100	0.0750	0.20		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.42"
3.0	271	0.0055	1.51		**Shallow Concentrated Flow, SEG 2** Paved Kv= 20.3 fps
3.1	300	0.0100	1.61		**Shallow Concentrated Flow, SEG 3** Unpaved Kv= 16.1 fps
1.1	172	0.0262	2.61		**Shallow Concentrated Flow, SEG 4** Unpaved Kv= 16.1 fps
15.3	843	Total			

Subcatchment P1-4:



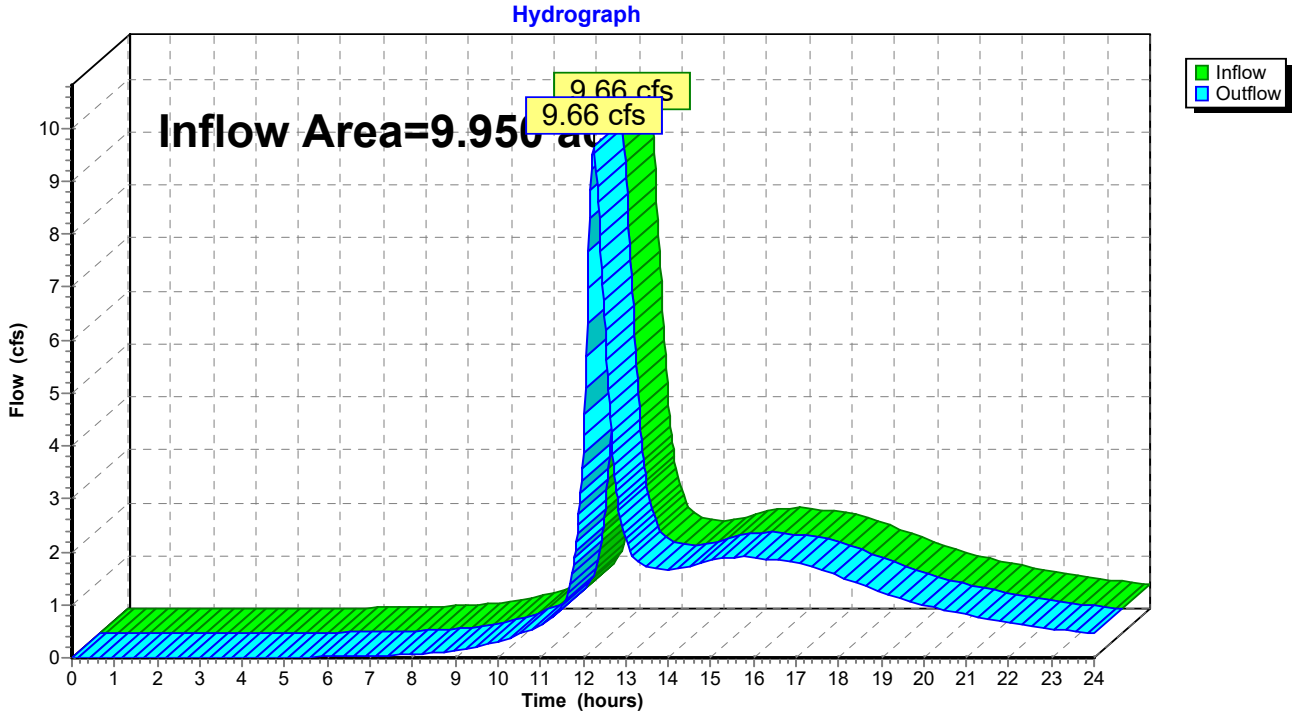
Summary for Reach 1R: DRAINAGE TRUNK LINE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 9.950 ac, 47.84% Impervious, Inflow Depth > 2.20" for 2-Year event
Inflow = 9.66 cfs @ 12.25 hrs, Volume= 1.823 af
Outflow = 9.66 cfs @ 12.25 hrs, Volume= 1.823 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach 1R: DRAINAGE TRUNK LINE



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1-1: Runoff Area=3.500 ac 100.00% Impervious Runoff Depth>4.75"
Tc=366.0 min CN=98 Runoff=2.29 cfs 1.385 af

Subcatchment P1-2: Runoff Area=2.340 ac 29.06% Impervious Runoff Depth>3.82"
Flow Length=170' Tc=18.7 min CN=85 Runoff=7.21 cfs 0.745 af

Subcatchment P1-3: Runoff Area=2.250 ac 3.11% Impervious Runoff Depth>3.42"
Flow Length=587' Tc=22.3 min CN=81 Runoff=5.82 cfs 0.641 af

Subcatchment P1-4: Runoff Area=1.860 ac 27.42% Impervious Runoff Depth>3.82"
Flow Length=843' Tc=15.3 min CN=85 Runoff=6.20 cfs 0.593 af

Reach 1R: DRAINAGE TRUNK LINE Inflow=19.20 cfs 3.363 af
Outflow=19.20 cfs 3.363 af

Total Runoff Area = 9.950 ac Runoff Volume = 3.363 af Average Runoff Depth = 4.06"
52.16% Pervious = 5.190 ac 47.84% Impervious = 4.760 ac

Summary for Subcatchment P1-1:

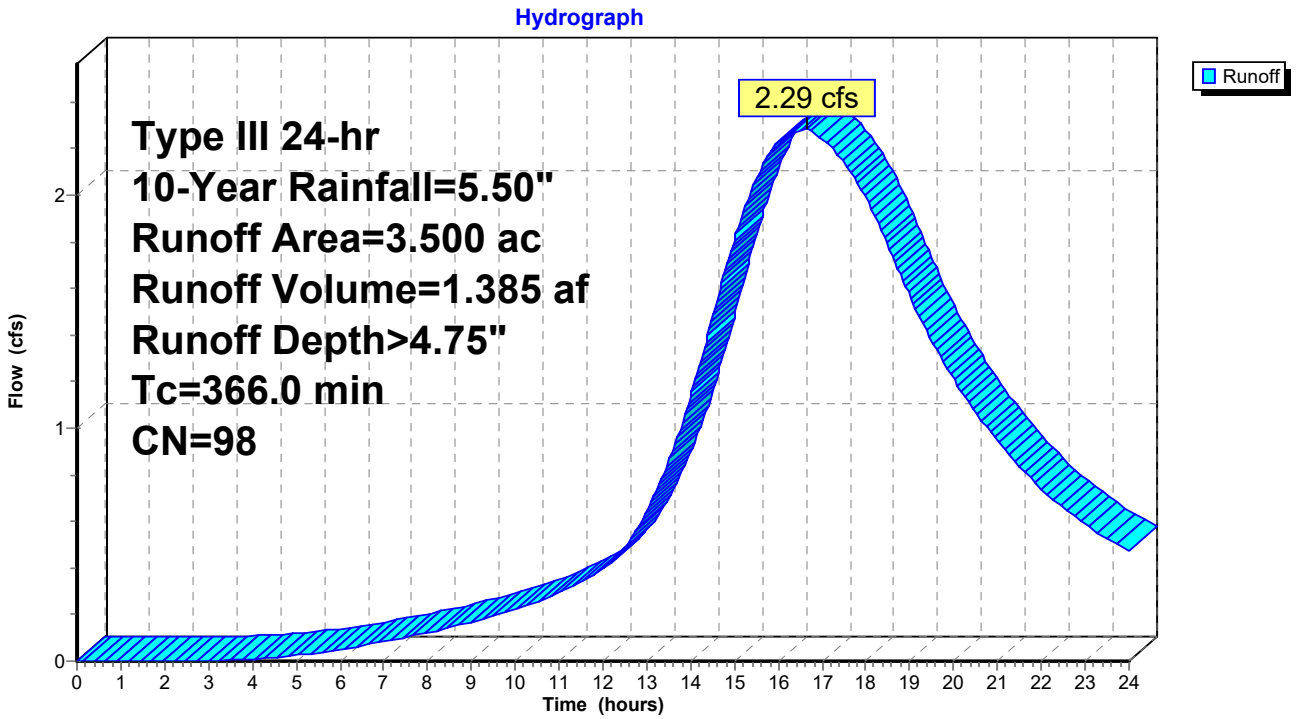
Runoff = 2.29 cfs @ 16.67 hrs, Volume= 1.385 af, Depth> 4.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	3.500	98	Turf
	3.500		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Time to pond**
360.0					**Direct Entry, Time to reach flat panel**
366.0	0	Total			

Subcatchment P1-1:



Summary for Subcatchment P1-2:

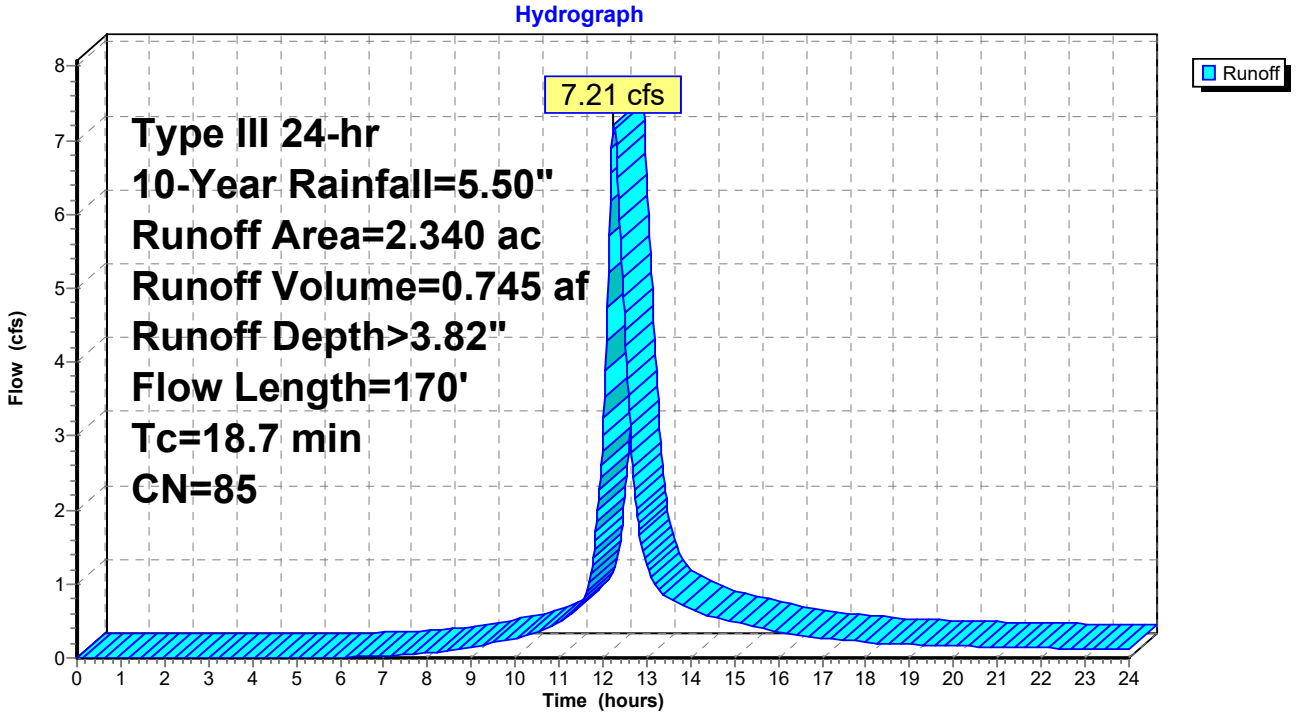
Runoff = 7.21 cfs @ 12.25 hrs, Volume= 0.745 af, Depth> 3.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Rainfall=5.50"

Area (ac)	CN	Description
0.680	98	Paved parking, HSG D
1.660	80	>75% Grass cover, Good, HSG D
2.340	85	Weighted Average
1.660		70.94% Pervious Area
0.680		29.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.0100	0.09		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.42"
0.5	70	0.0179	2.15		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
18.7	170	Total			

Subcatchment P1-2:



Summary for Subcatchment P1-3:

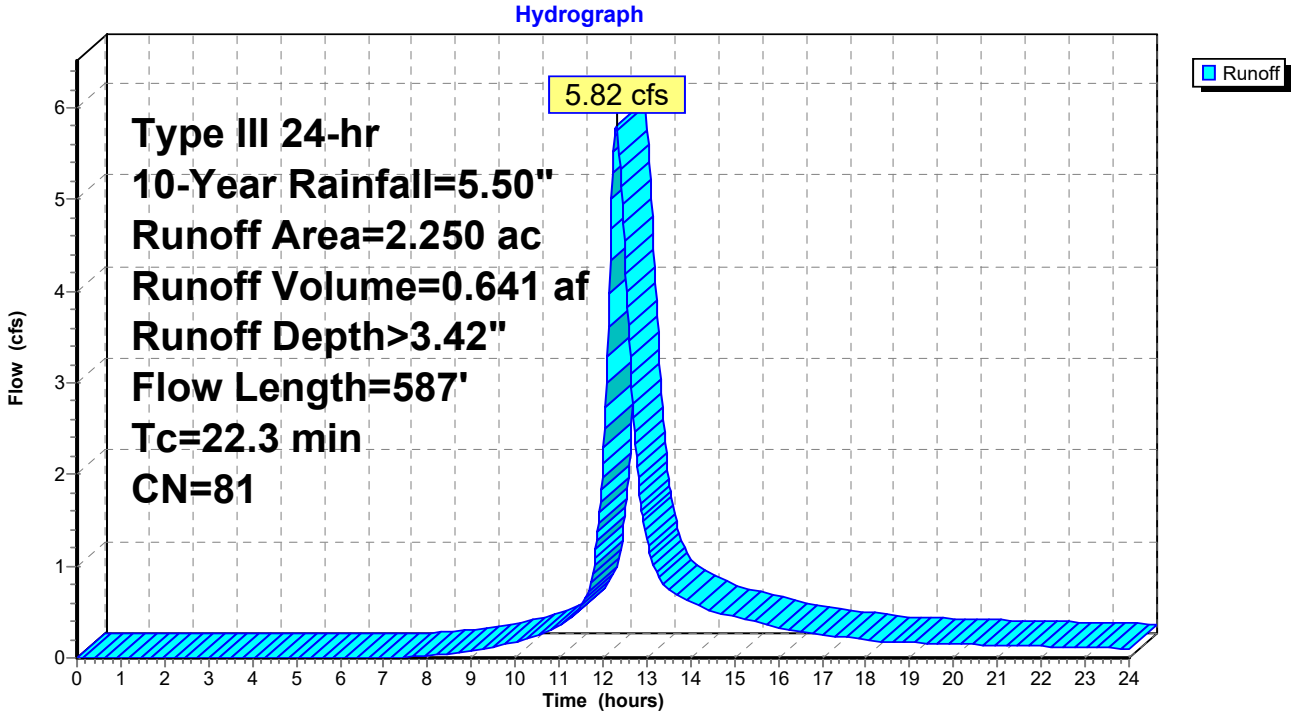
Runoff = 5.82 cfs @ 12.31 hrs, Volume= 0.641 af, Depth> 3.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Rainfall=5.50"

Area (ac)	CN	Description
0.070	98	Paved parking, HSG D
2.180	80	>75% Grass cover, Good, HSG D
2.250	81	Weighted Average
2.180		96.89% Pervious Area
0.070		3.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.0100	0.09		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.42"
4.1	487	0.0154	2.00		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
22.3	587	Total			

Subcatchment P1-3:



Summary for Subcatchment P1-4:

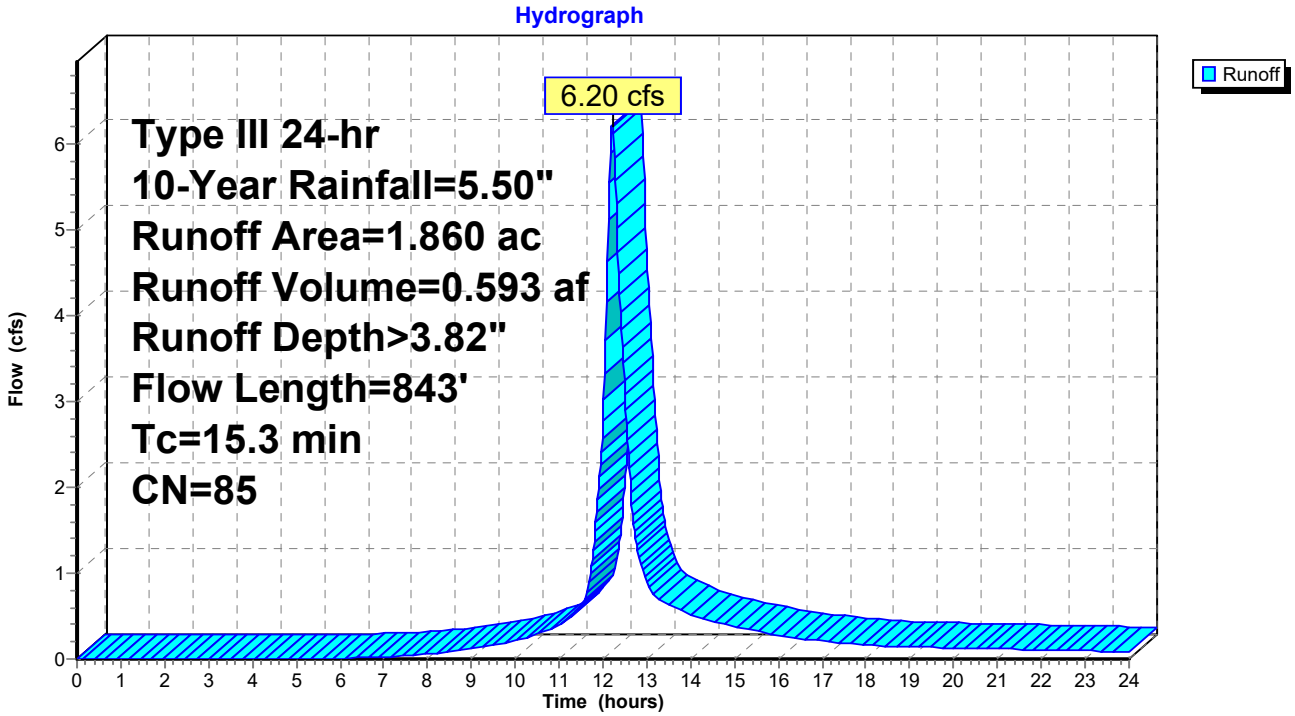
Runoff = 6.20 cfs @ 12.21 hrs, Volume= 0.593 af, Depth> 3.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Year Rainfall=5.50"

Area (ac)	CN	Description
0.510	98	Paved parking, HSG D
1.350	80	>75% Grass cover, Good, HSG D
1.860	85	Weighted Average
1.350		72.58% Pervious Area
0.510		27.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	100	0.0750	0.20		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.42"
3.0	271	0.0055	1.51		**Shallow Concentrated Flow, SEG 2** Paved Kv= 20.3 fps
3.1	300	0.0100	1.61		**Shallow Concentrated Flow, SEG 3** Unpaved Kv= 16.1 fps
1.1	172	0.0262	2.61		**Shallow Concentrated Flow, SEG 4** Unpaved Kv= 16.1 fps
15.3	843	Total			

Subcatchment P1-4:



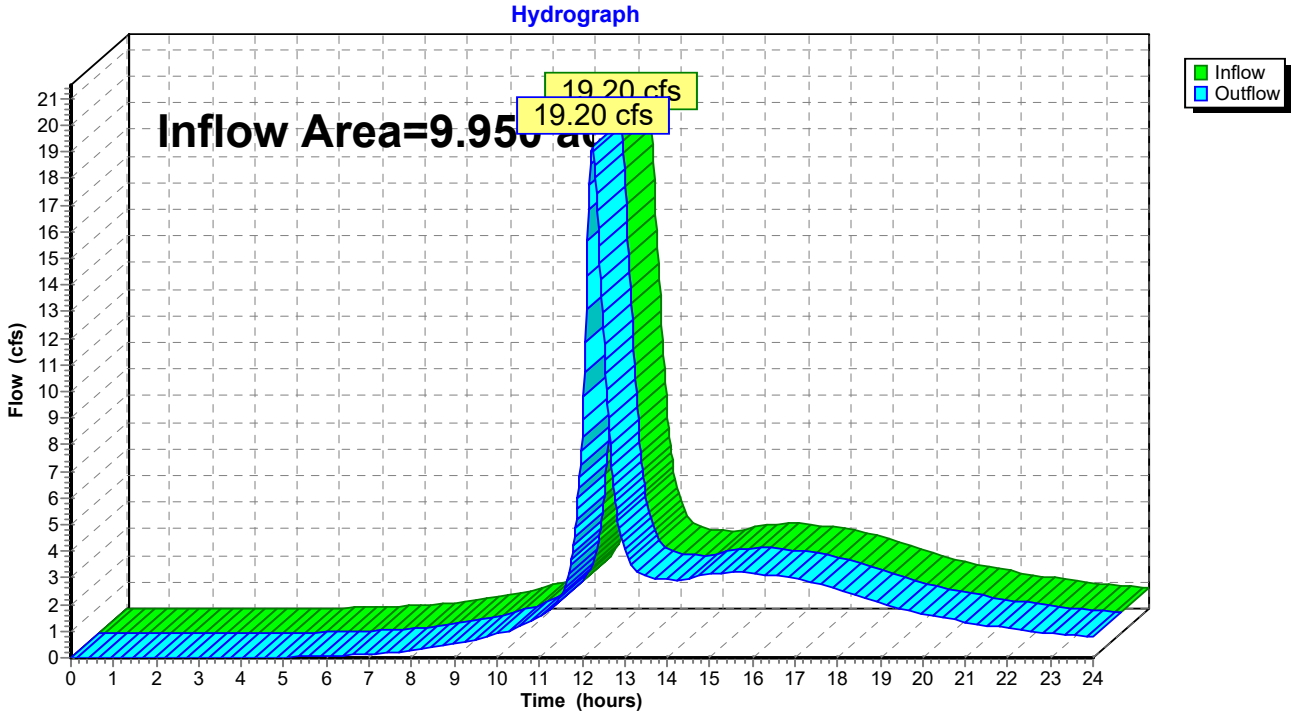
Summary for Reach 1R: DRAINAGE TRUNK LINE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 9.950 ac, 47.84% Impervious, Inflow Depth > 4.06" for 10-Year event
Inflow = 19.20 cfs @ 12.25 hrs, Volume= 3.363 af
Outflow = 19.20 cfs @ 12.25 hrs, Volume= 3.363 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach 1R: DRAINAGE TRUNK LINE



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1-1: Runoff Area=3.500 ac 100.00% Impervious Runoff Depth>5.93"
Tc=366.0 min CN=98 Runoff=2.84 cfs 1.728 af

Subcatchment P1-2: Runoff Area=2.340 ac 29.06% Impervious Runoff Depth>5.05"
Flow Length=170' Tc=18.7 min CN=85 Runoff=9.43 cfs 0.984 af

Subcatchment P1-3: Runoff Area=2.250 ac 3.11% Impervious Runoff Depth>4.60"
Flow Length=587' Tc=22.3 min CN=81 Runoff=7.79 cfs 0.863 af

Subcatchment P1-4: Runoff Area=1.860 ac 27.42% Impervious Runoff Depth>5.05"
Flow Length=843' Tc=15.3 min CN=85 Runoff=8.11 cfs 0.783 af

Reach 1R: DRAINAGE TRUNK LINE Inflow=25.27 cfs 4.357 af
Outflow=25.27 cfs 4.357 af

Total Runoff Area = 9.950 ac Runoff Volume = 4.357 af Average Runoff Depth = 5.26"
52.16% Pervious = 5.190 ac 47.84% Impervious = 4.760 ac

Summary for Subcatchment P1-1:

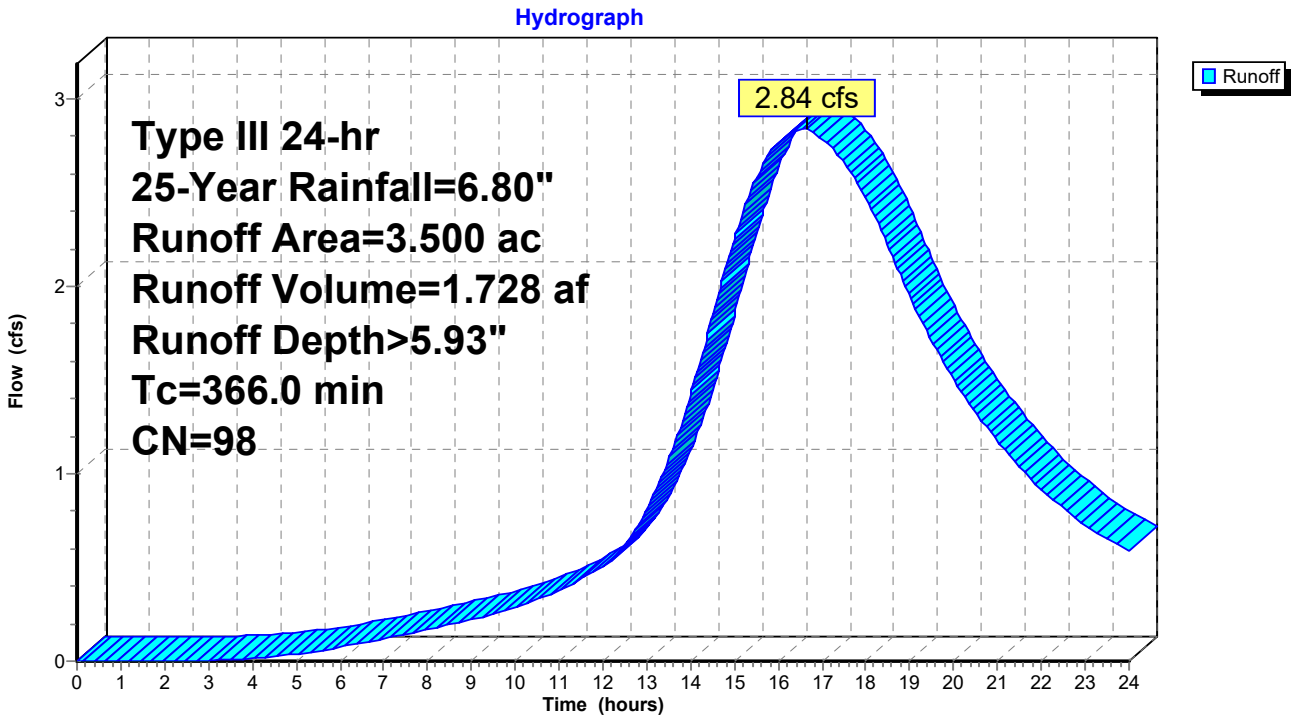
Runoff = 2.84 cfs @ 16.67 hrs, Volume= 1.728 af, Depth> 5.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Rainfall=6.80"

	Area (ac)	CN	Description
*	3.500	98	Turf
	3.500		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Time to pond**
360.0					**Direct Entry, Time to reach flat panel**
366.0	0	Total			

Subcatchment P1-1:



Summary for Subcatchment P1-2:

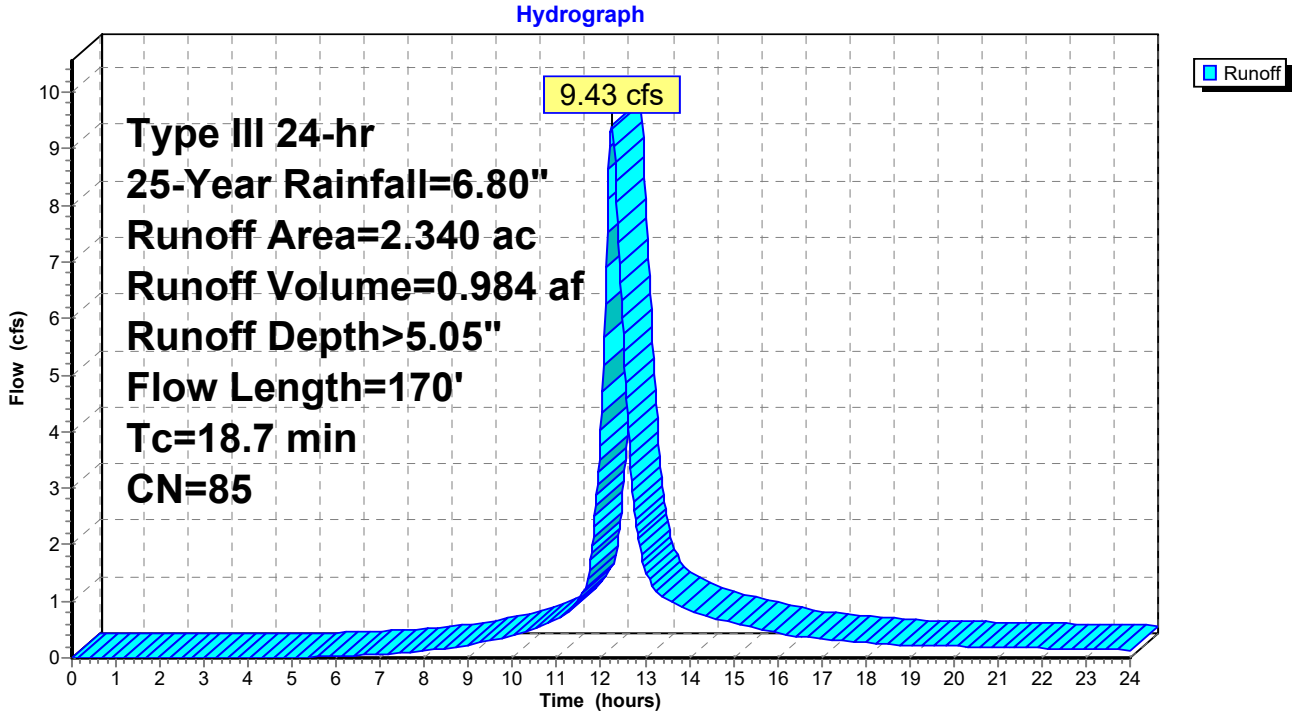
Runoff = 9.43 cfs @ 12.25 hrs, Volume= 0.984 af, Depth> 5.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Rainfall=6.80"

Area (ac)	CN	Description
0.680	98	Paved parking, HSG D
1.660	80	>75% Grass cover, Good, HSG D
2.340	85	Weighted Average
1.660		70.94% Pervious Area
0.680		29.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.0100	0.09		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.42"
0.5	70	0.0179	2.15		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
18.7	170	Total			

Subcatchment P1-2:



Summary for Subcatchment P1-3:

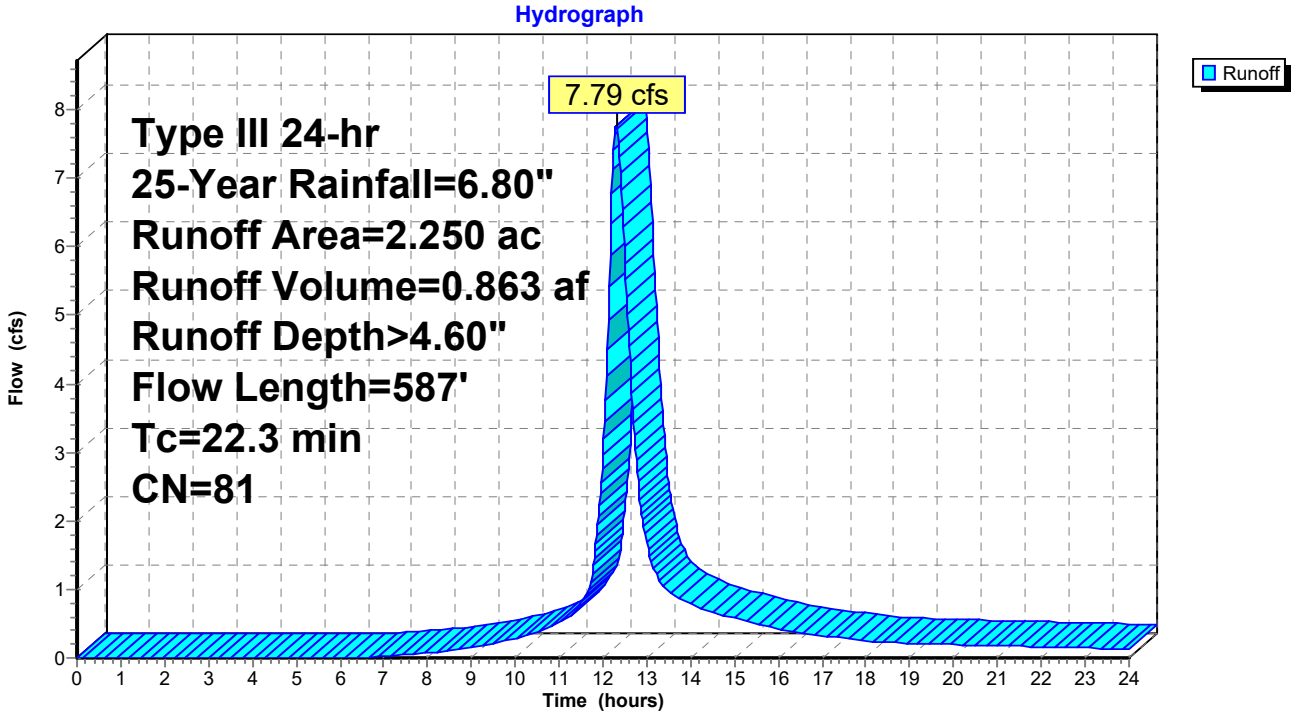
Runoff = 7.79 cfs @ 12.30 hrs, Volume= 0.863 af, Depth> 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Rainfall=6.80"

Area (ac)	CN	Description
0.070	98	Paved parking, HSG D
2.180	80	>75% Grass cover, Good, HSG D
2.250	81	Weighted Average
2.180		96.89% Pervious Area
0.070		3.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.0100	0.09		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.42"
4.1	487	0.0154	2.00		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
22.3	587	Total			

Subcatchment P1-3:



Summary for Subcatchment P1-4:

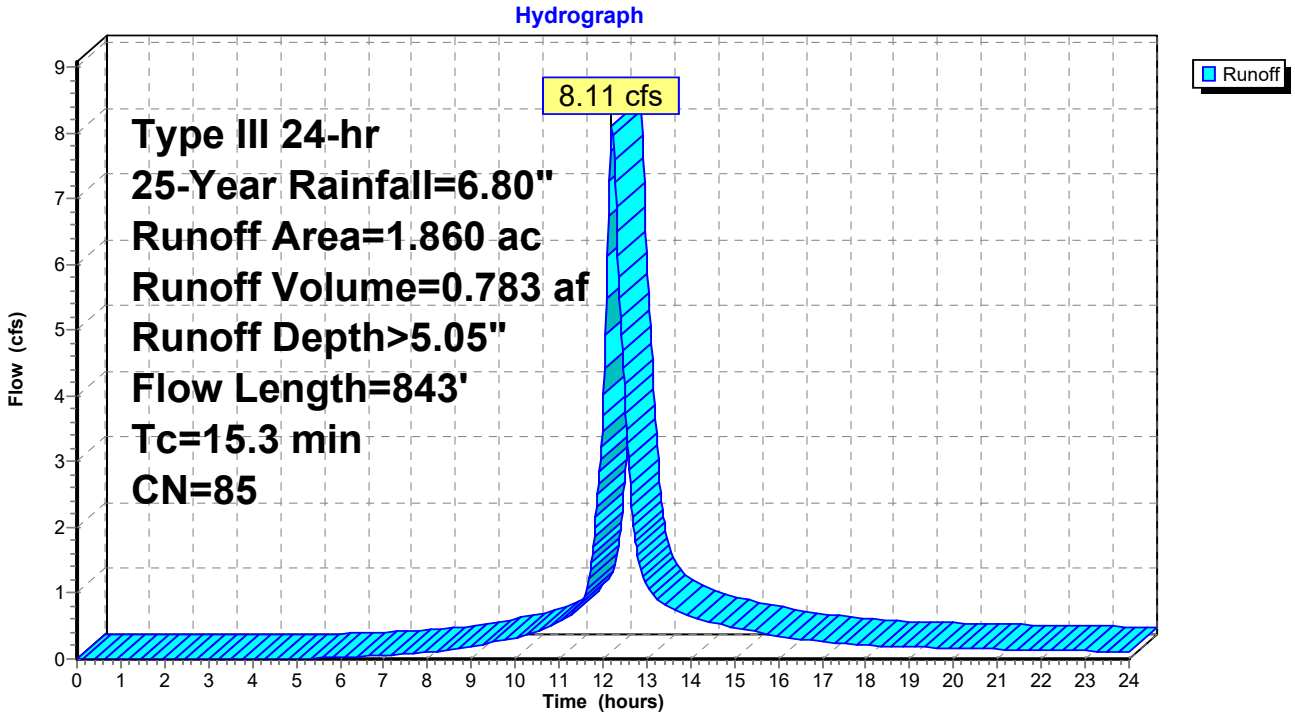
Runoff = 8.11 cfs @ 12.20 hrs, Volume= 0.783 af, Depth> 5.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-Year Rainfall=6.80"

Area (ac)	CN	Description
0.510	98	Paved parking, HSG D
1.350	80	>75% Grass cover, Good, HSG D
1.860	85	Weighted Average
1.350		72.58% Pervious Area
0.510		27.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	100	0.0750	0.20		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.42"
3.0	271	0.0055	1.51		**Shallow Concentrated Flow, SEG 2** Paved Kv= 20.3 fps
3.1	300	0.0100	1.61		**Shallow Concentrated Flow, SEG 3** Unpaved Kv= 16.1 fps
1.1	172	0.0262	2.61		**Shallow Concentrated Flow, SEG 4** Unpaved Kv= 16.1 fps
15.3	843	Total			

Subcatchment P1-4:



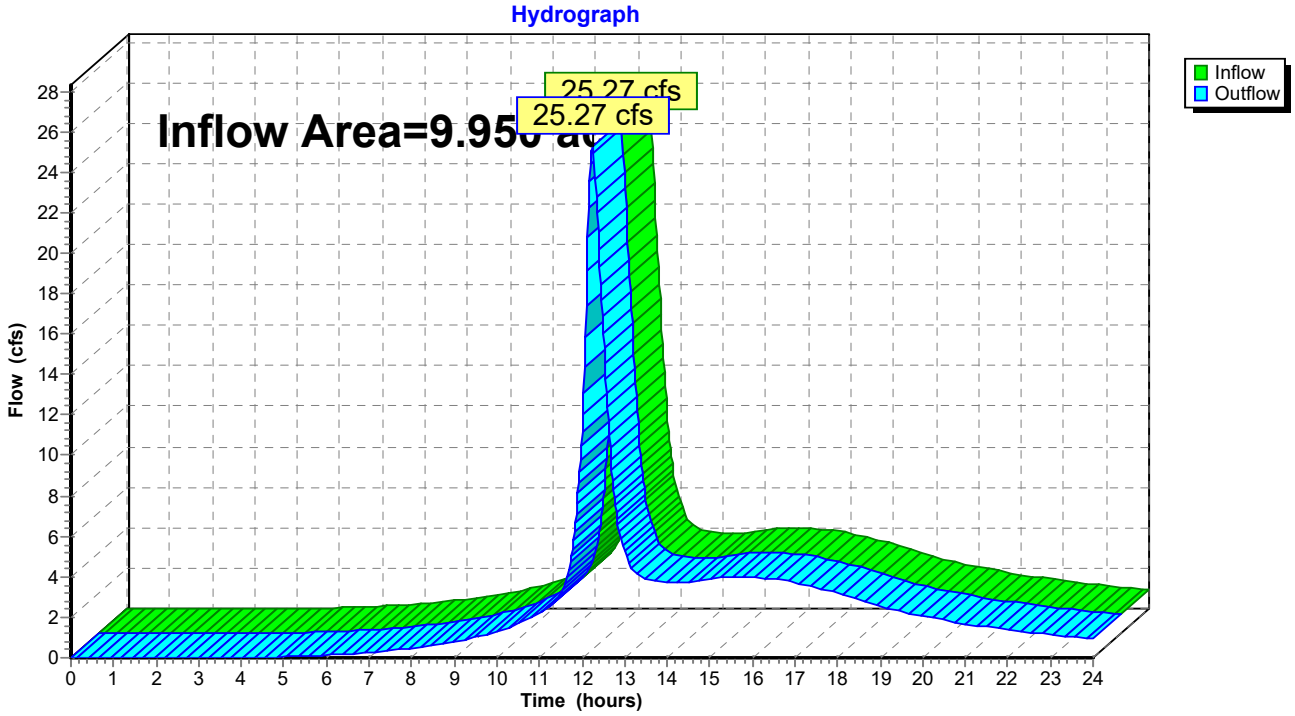
Summary for Reach 1R: DRAINAGE TRUNK LINE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 9.950 ac, 47.84% Impervious, Inflow Depth > 5.26" for 25-Year event
Inflow = 25.27 cfs @ 12.24 hrs, Volume= 4.357 af
Outflow = 25.27 cfs @ 12.24 hrs, Volume= 4.357 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach 1R: DRAINAGE TRUNK LINE



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1-1: Runoff Area=3.500 ac 100.00% Impervious Runoff Depth>7.75"
Tc=366.0 min CN=98 Runoff=3.70 cfs 2.259 af

Subcatchment P1-2: Runoff Area=2.340 ac 29.06% Impervious Runoff Depth>6.98"
Flow Length=170' Tc=18.7 min CN=85 Runoff=12.85 cfs 1.360 af

Subcatchment P1-3: Runoff Area=2.250 ac 3.11% Impervious Runoff Depth>6.49"
Flow Length=587' Tc=22.3 min CN=81 Runoff=10.85 cfs 1.216 af

Subcatchment P1-4: Runoff Area=1.860 ac 27.42% Impervious Runoff Depth>6.98"
Flow Length=843' Tc=15.3 min CN=85 Runoff=11.04 cfs 1.082 af

Reach 1R: DRAINAGE TRUNK LINE Inflow=34.66 cfs 5.917 af
Outflow=34.66 cfs 5.917 af

Total Runoff Area = 9.950 ac Runoff Volume = 5.917 af Average Runoff Depth = 7.14"
52.16% Pervious = 5.190 ac 47.84% Impervious = 4.760 ac

Summary for Subcatchment P1-1:

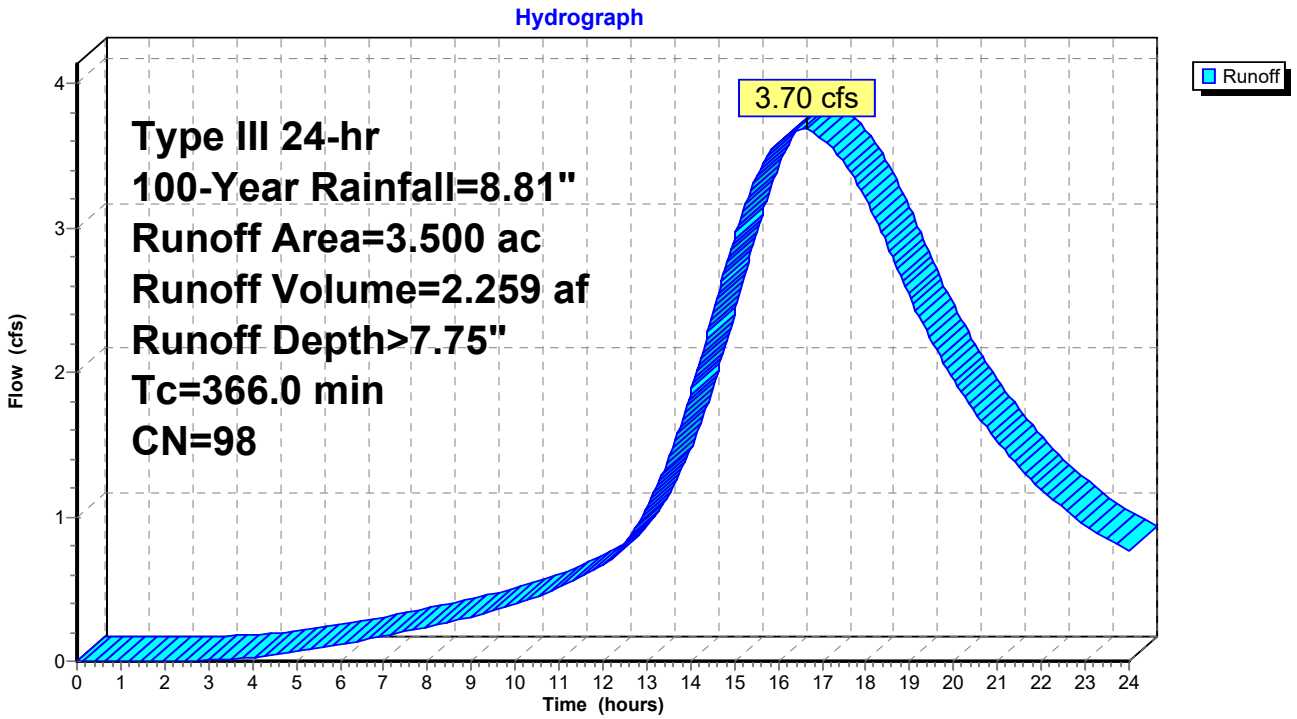
Runoff = 3.70 cfs @ 16.67 hrs, Volume= 2.259 af, Depth> 7.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=8.81"

	Area (ac)	CN	Description
*	3.500	98	Turf
	3.500		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Time to pond**
360.0					**Direct Entry, Time to reach flat panel**
366.0	0	Total			

Subcatchment P1-1:



Summary for Subcatchment P1-2:

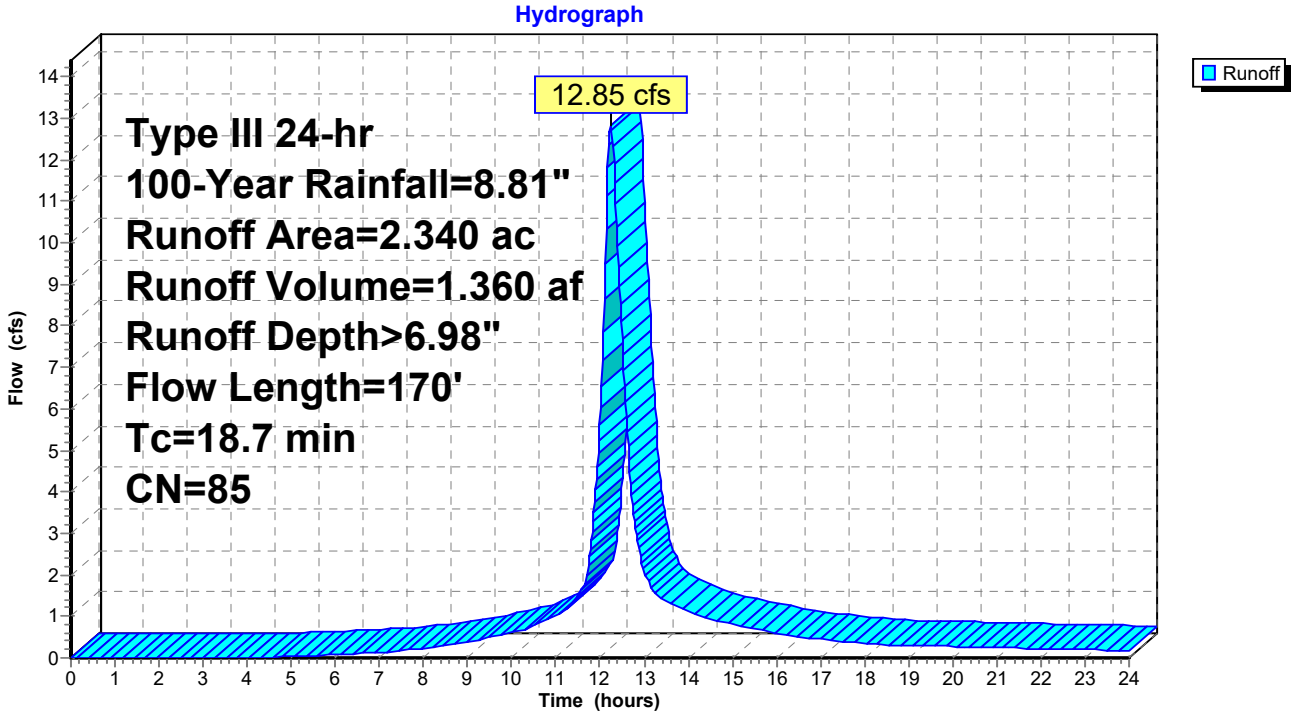
Runoff = 12.85 cfs @ 12.25 hrs, Volume= 1.360 af, Depth> 6.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=8.81"

Area (ac)	CN	Description
0.680	98	Paved parking, HSG D
1.660	80	>75% Grass cover, Good, HSG D
2.340	85	Weighted Average
1.660		70.94% Pervious Area
0.680		29.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.0100	0.09		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.42"
0.5	70	0.0179	2.15		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
18.7	170	Total			

Subcatchment P1-2:



Summary for Subcatchment P1-3:

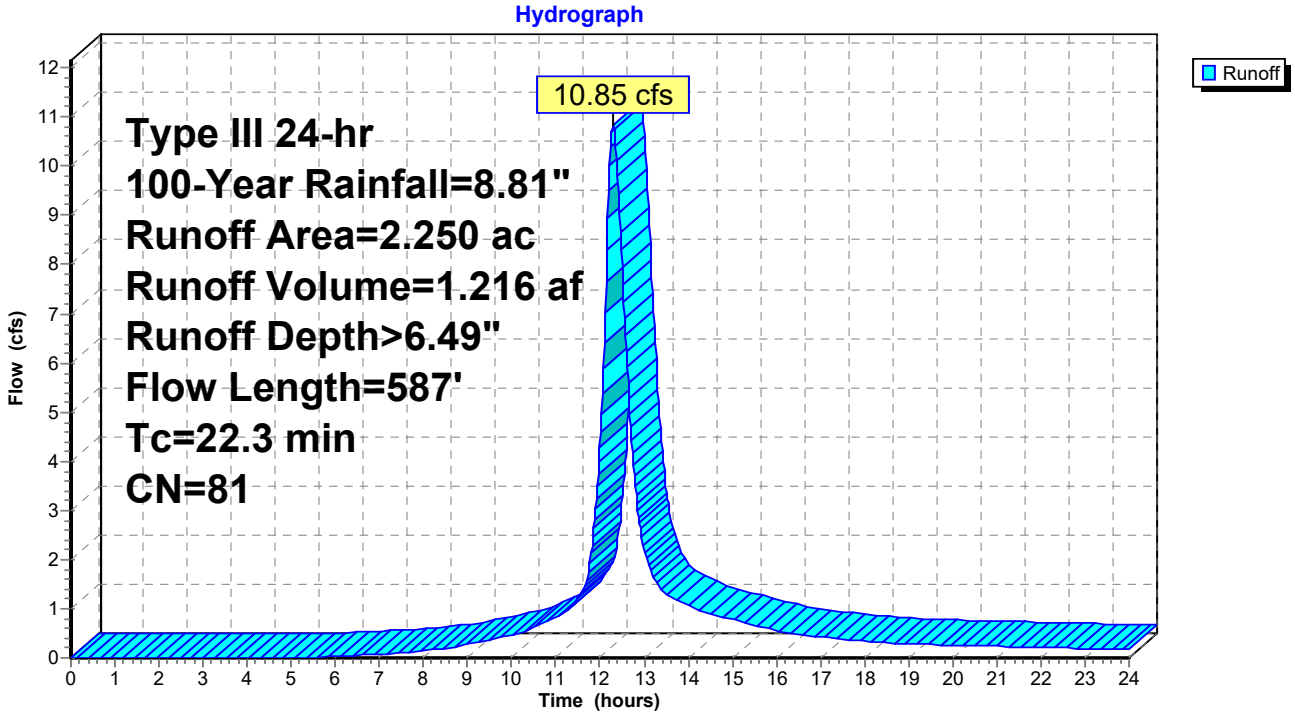
Runoff = 10.85 cfs @ 12.30 hrs, Volume= 1.216 af, Depth> 6.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=8.81"

Area (ac)	CN	Description
0.070	98	Paved parking, HSG D
2.180	80	>75% Grass cover, Good, HSG D
2.250	81	Weighted Average
2.180		96.89% Pervious Area
0.070		3.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.0100	0.09		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.42"
4.1	487	0.0154	2.00		**Shallow Concentrated Flow, SEG 2** Unpaved Kv= 16.1 fps
22.3	587	Total			

Subcatchment P1-3:



Summary for Subcatchment P1-4:

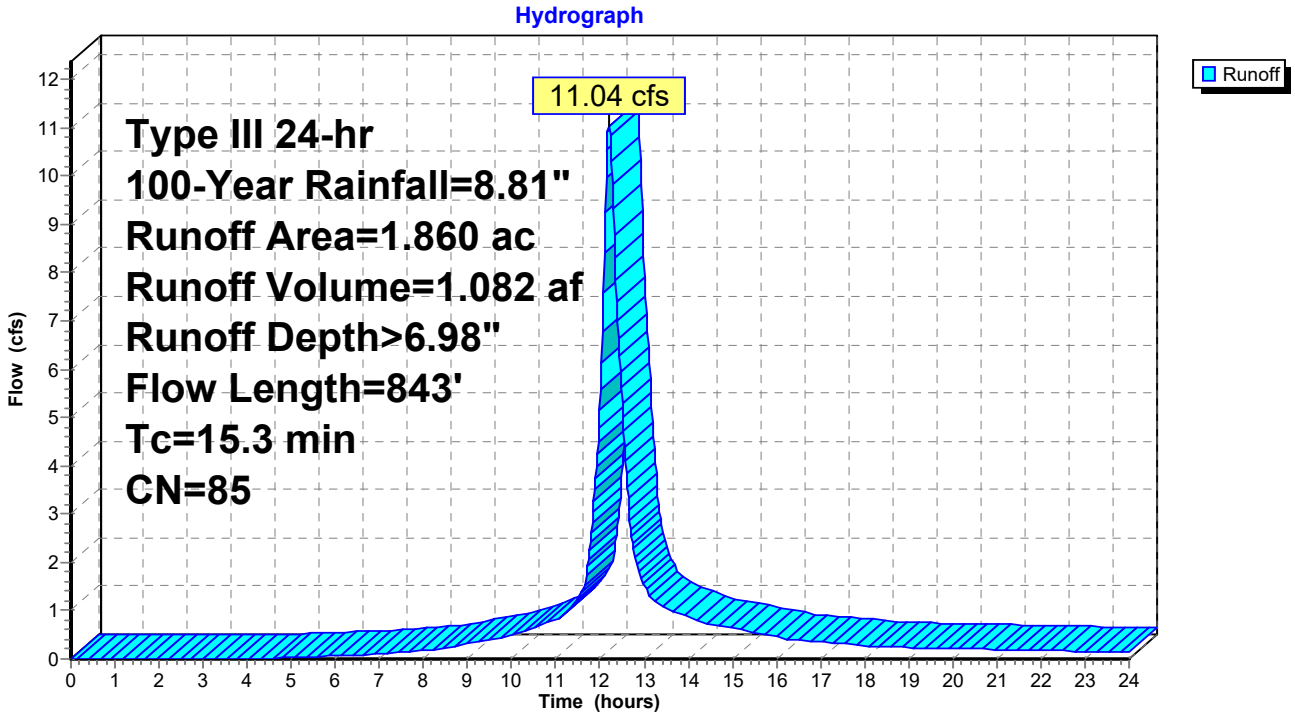
Runoff = 11.04 cfs @ 12.20 hrs, Volume= 1.082 af, Depth> 6.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Year Rainfall=8.81"

Area (ac)	CN	Description
0.510	98	Paved parking, HSG D
1.350	80	>75% Grass cover, Good, HSG D
1.860	85	Weighted Average
1.350		72.58% Pervious Area
0.510		27.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	100	0.0750	0.20		**Sheet Flow, SEG 1** Grass: Dense n= 0.240 P2= 3.42"
3.0	271	0.0055	1.51		**Shallow Concentrated Flow, SEG 2** Paved Kv= 20.3 fps
3.1	300	0.0100	1.61		**Shallow Concentrated Flow, SEG 3** Unpaved Kv= 16.1 fps
1.1	172	0.0262	2.61		**Shallow Concentrated Flow, SEG 4** Unpaved Kv= 16.1 fps
15.3	843	Total			

Subcatchment P1-4:



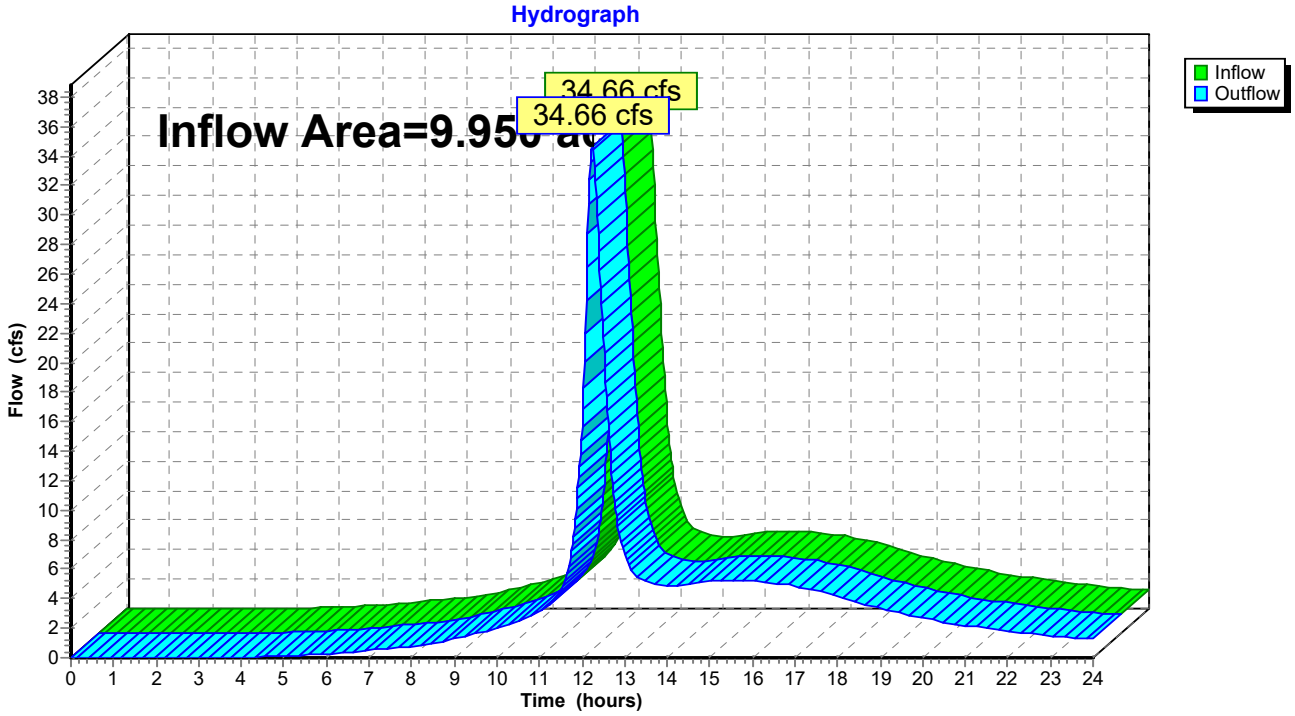
Summary for Reach 1R: DRAINAGE TRUNK LINE

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 9.950 ac, 47.84% Impervious, Inflow Depth > 7.14" for 100-Year event
Inflow = 34.66 cfs @ 12.24 hrs, Volume= 5.917 af
Outflow = 34.66 cfs @ 12.24 hrs, Volume= 5.917 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

Reach 1R: DRAINAGE TRUNK LINE

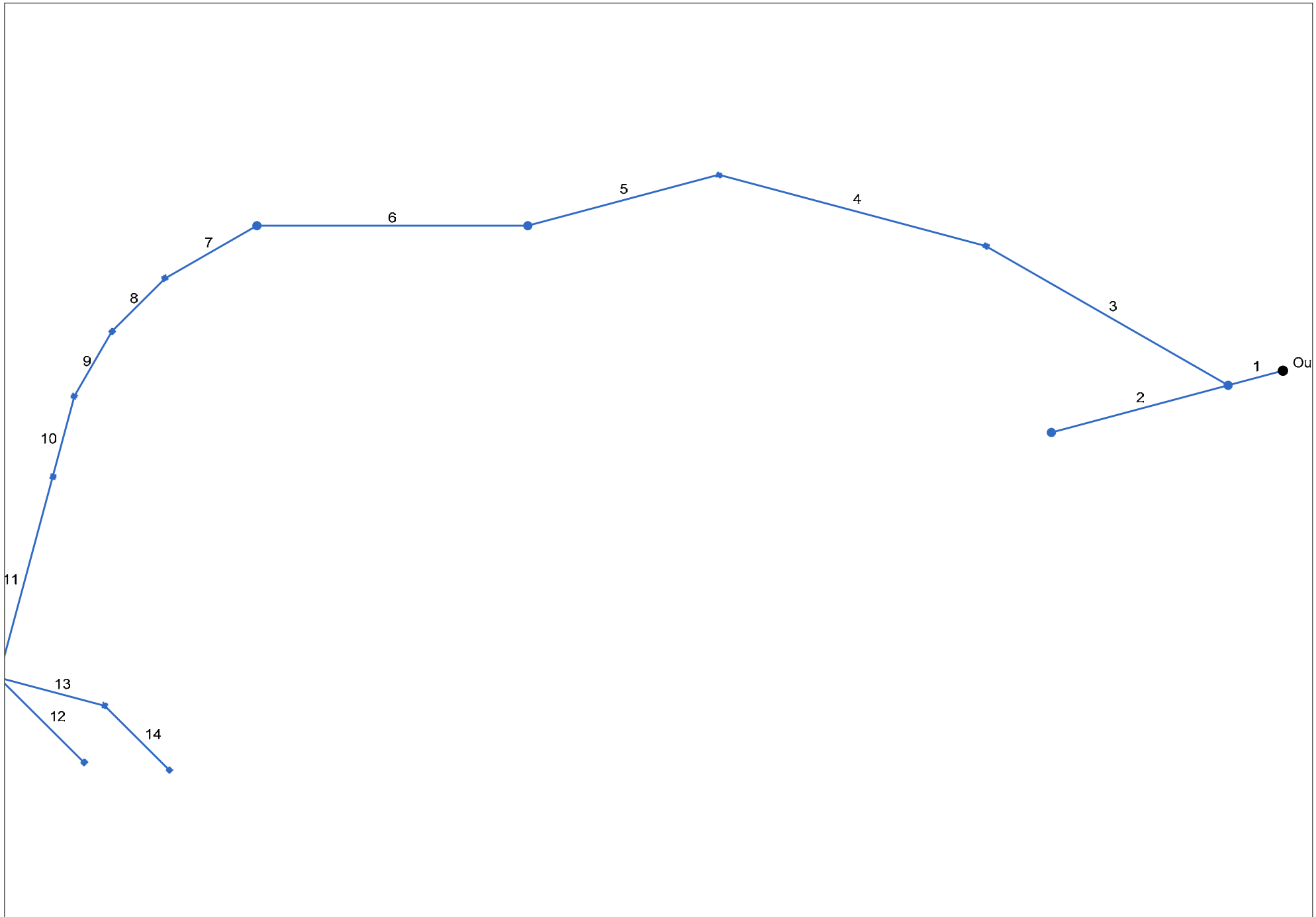


APPENDIX C

Stormwater Drainage Sizing Computations

BSC GROUP

Avon High School Track & Field



Project File: Storm System.stm	Number of lines: 14	Date: 10/2/2018

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	31.000	165.000	MH	0.00	0.00	0.00	0.0	263.40	1.13	263.75	15	Cir	0.011	0.75	268.80	DMH 1
2	1	100.000	0.000	MH	1.50	0.00	0.00	0.0	266.55	4.00	270.55	12	Cir	0.011	1.00	276.07	DMH 2
3	1	153.000	45.000	DrGrt	0.00	0.50	0.33	5.0	263.85	1.00	265.38	15	Cir	0.011	0.50	273.25	AD 1
4	3	151.000	-15.000	DrGrt	0.00	0.42	0.41	5.0	265.38	1.00	266.89	15	Cir	0.011	0.83	274.50	AD 2
5	4	108.000	-30.000	MH	0.20	0.00	0.00	0.0	266.89	1.00	267.97	15	Cir	0.011	0.31	276.23	DMH 3
6	5	148.000	15.000	MH	0.00	0.00	0.00	0.0	268.07	1.00	269.55	15	Cir	0.011	0.56	284.25	DMH 4
7	6	58.000	-30.000	DrGrt	0.00	0.05	0.43	5.0	269.80	0.76	270.24	12	Cir	0.011	0.50	276.00	AD 3
8	7	41.000	-15.000	DrGrt	0.00	0.04	0.47	5.0	270.24	0.76	270.55	12	Cir	0.011	0.50	276.00	AD 4
9	8	41.000	-15.000	DrGrt	0.00	0.06	0.46	5.0	270.55	0.76	270.86	12	Cir	0.011	0.50	276.00	AD 5
10	9	46.000	-15.000	DrGrt	0.00	0.10	0.41	5.0	270.86	0.76	271.21	12	Cir	0.011	0.50	276.00	AD 6
11	10	114.000	0.000	DrGrt	0.00	0.17	0.46	5.0	271.21	0.75	272.06	12	Cir	0.011	1.50	276.00	AD 7
12	11	66.000	-60.000	DrGrt	0.00	0.13	0.37	5.0	272.18	2.00	273.50	12	Cir	0.011	1.00	276.50	AD 8
13	11	60.000	-90.000	DrGrt	0.00	0.36	0.45	5.0	272.16	0.75	272.61	12	Cir	0.011	0.83	275.50	AD 9
14	13	50.000	30.000	DrGrt	0.00	0.13	0.41	5.0	272.61	0.76	272.99	12	Cir	0.011	1.00	276.00	AD 10

Avon High School Track & Field | Number of lines: 14 | Date: 10/2/2018

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	DMH 1	Manhole	268.80	Cir	4.00	4.00	15	Cir	263.75	12 15	Cir Cir	266.55 263.85
2	DMH 2	Manhole	276.07	Cir	4.00	4.00	12	Cir	270.55			
3	AD 1	DropGrate	273.25	Rect	2.50	2.50	15	Cir	265.38	15	Cir	265.38
4	AD 2	DropGrate	274.50	Rect	2.50	2.50	15	Cir	266.89	15	Cir	266.89
5	DMH 3	Manhole	276.23	Cir	4.00	4.00	15	Cir	267.97	15	Cir	268.07
6	DMH 4	Manhole	284.25	Cir	4.00	4.00	15	Cir	269.55	12	Cir	269.80
7	AD 3	DropGrate	276.00	Rect	2.50	2.50	12	Cir	270.24	12	Cir	270.24
8	AD 4	DropGrate	276.00	Rect	2.50	2.50	12	Cir	270.55	12	Cir	270.55
9	AD 5	DropGrate	276.00	Rect	2.50	2.50	12	Cir	270.86	12	Cir	270.86
10	AD 6	DropGrate	276.00	Rect	2.50	2.50	12	Cir	271.21	12	Cir	271.21
11	AD 7	DropGrate	276.00	Rect	2.50	2.50	12	Cir	272.06	12 12	Cir Cir	272.18 272.16
12	AD 8	DropGrate	276.50	Rect	2.50	2.50	12	Cir	273.50			
13	AD 9	DropGrate	275.50	Rect	2.50	2.50	12	Cir	272.61	12	Cir	272.61
14	AD 10	DropGrate	276.00	Rect	2.50	2.50	12	Cir	272.99			

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	31.000	0.00	1.96	0.00	0.00	0.79	0.0	13.4	4.3	5.06	8.11	6.96	15	1.13	263.40	263.75	264.12	264.47	268.41	268.80	DMH 1
2	1	100.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.50	8.42	8.09	12	4.00	266.55	270.55	266.84	270.84	268.80	276.07	DMH 2
3	1	153.000	0.50	1.96	0.33	0.17	0.79	5.0	12.7	4.4	3.64	7.63	6.10	15	1.00	263.85	265.38	264.47	265.99	268.80	273.25	AD 1
4	3	151.000	0.42	1.46	0.41	0.17	0.62	5.0	11.8	4.5	3.00	7.63	5.46	15	1.00	265.38	266.89	265.99	267.43	273.25	274.50	AD 2
5	4	108.000	0.00	1.04	0.00	0.00	0.45	0.0	11.0	4.6	2.29	7.63	4.94	15	1.00	266.89	267.97	267.43	268.44	274.50	276.23	DMH 3
6	5	148.000	0.00	1.04	0.00	0.00	0.45	0.0	9.8	4.9	2.18	7.63	5.36	15	1.00	268.07	269.55	268.53	270.01	276.23	284.25	DMH 4
7	6	58.000	0.05	1.04	0.43	0.02	0.45	5.0	9.5	4.9	2.21	3.67	4.88	12	0.76	269.80	270.24	270.36	270.80	284.25	276.00	AD 3
8	7	41.000	0.04	0.99	0.47	0.02	0.43	5.0	9.2	5.0	2.12	3.66	4.76	12	0.76	270.24	270.55	270.80	271.10	276.00	276.00	AD 4
9	8	41.000	0.06	0.95	0.46	0.03	0.41	5.0	9.0	5.0	2.05	3.66	4.72	12	0.76	270.55	270.86	271.10	271.40	276.00	276.00	AD 5
10	9	46.000	0.10	0.89	0.41	0.04	0.38	5.0	8.7	5.1	1.93	3.67	4.62	12	0.76	270.86	271.21	271.40	271.73	276.00	276.00	AD 6
11	10	114.000	0.17	0.79	0.46	0.08	0.34	5.0	8.0	5.2	1.78	3.63	4.48	12	0.75	271.21	272.06	271.73	272.55	276.00	276.00	AD 7
12	11	66.000	0.13	0.13	0.37	0.05	0.05	5.0	5.0	6.0	0.29	5.95	2.49	12	2.00	272.18	273.50	272.55	273.65	276.00	276.50	AD 8
13	11	60.000	0.36	0.49	0.45	0.16	0.22	5.0	7.1	5.4	1.17	3.64	4.10	12	0.75	272.16	272.61	272.55	273.00	276.00	275.50	AD 9
14	13	50.000	0.13	0.13	0.41	0.05	0.05	5.0	5.0	6.0	0.32	3.67	2.00	12	0.76	272.61	272.99	273.00	273.19	275.50	276.00	AD 10

Avon High School Track & Field | Number of lines: 14 | Run Date: 10/2/2018

NOTES:Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period =Yrs. 10 ; c = cir e = ellip b = box

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	DMH 1	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
2	DMH 2	1.50*	0.00	0.00	1.50	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
3	AD 1	0.99	0.00	0.99	0.00	DrGrt	0.0	0.00	3.14	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.12	13.91	0.12	13.91	0.0	Off
4	AD 2	1.03	0.00	1.03	0.00	DrGrt	0.0	0.00	3.14	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.12	14.26	0.12	14.26	0.0	Off
5	DMH 3	0.20*	0.00	0.00	0.20	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
6	DMH 4	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
7	AD 3	0.13	0.00	0.13	0.00	DrGrt	0.0	0.00	3.14	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.03	5.06	0.03	5.06	0.0	Off
8	AD 4	0.11	0.00	0.11	0.00	DrGrt	0.0	0.00	3.14	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.03	4.80	0.03	4.80	0.0	Off
9	AD 5	0.17	0.00	0.17	0.00	DrGrt	0.0	0.00	3.14	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.04	5.61	0.04	5.61	0.0	Off
10	AD 6	0.25	0.00	0.25	0.00	DrGrt	0.0	0.00	3.14	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.05	6.71	0.05	6.71	0.0	Off
11	AD 7	0.47	0.00	0.47	0.00	DrGrt	0.0	0.00	3.14	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.07	9.24	0.07	9.24	0.0	Off
12	AD 8	0.29	0.00	0.29	0.00	DrGrt	0.0	0.00	3.14	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.05	7.24	0.05	7.24	0.0	Off
13	AD 9	0.97	0.00	0.97	0.00	DrGrt	0.0	0.00	3.14	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.12	13.77	0.12	13.77	0.0	Off
14	AD 10	0.32	0.00	0.32	0.00	DrGrt	0.0	0.00	3.14	2.00	2.00	Sag	2.00	0.020	0.020	0.000	0.06	7.61	0.06	7.61	0.0	Off

Avon High School Track & Field | Number of lines: 14 | Run Date: 10/2/2018

NOTES: Inlet N-Values = 0.016; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

APPENDIX D
Water Quality Calculations

BSC GROUP

All calculations in accordance with methodology outlined in the 2004 CT Stormwater Manual

Water Quality Volume (WQV)

Required:

$$WQV = \frac{(1")(R)(A)}{12}$$

I = Percent Impervious Area = 25.98%

A = Total Area = 9.94 acres

R = 0.05 + 0.009 × I = 0.05 + 0.009 × 25.98 = 0.28

$$WQV = \frac{(1")(0.28)(9.94)}{12} = 0.235 \text{ ac-ft} \times 43{,}560 \text{ sf/ac} = 10{,}245 \text{ cf}$$

Required WQV = 10,245 cf

Provided:

Volume of stone under synthetic grass field = 97,580 sf × 6.5 inches of stone × 40% voids = 21,142 cf

$WQV_{Provided} > WQV_{Required}$

Groundwater Recharge Volume (GRV)

$$GRV = \frac{(D)(A)(I)}{12}$$

A = Total Area = 9.94 acres

I = Total Impervious Area = 0.47

D = Groundwater Recharge Depth (Soil Group D) = 0”

$$GRV = \frac{(0")(9.94ac)(0.47)}{12} = 0$$

Time of Concentration – Synthetic Grass Field (Tc)

Time to pond:

6.0 minutes (min. time for water to pond)

Time to percolate through bottom stone to flat panel underdrains:

Infiltration Rate = 40 in/hr

Total distance to flat panel drain = 20 feet

$$20 \text{ ft} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{1 \text{ hr}}{40 \text{ in}} \times \frac{60 \text{ min}}{1 \text{ hr}} = 360 \text{ minutes}$$

Total Time of Concentration = 6 + 360 = 366 minutes

Geotechnical Engineering Report

Athletic Field Renovations

Avon, Connecticut

November 2, 2016

Terracon Project No. J2165145

Prepared for:

BSC Group – Connecticut, Inc.
Glastonbury, Connecticut

Prepared by:

Terracon Consultants, Inc.
Rocky Hill, Connecticut

November 2, 2016

BSC Group – Connecticut, Inc.
300 Winding Brook Drive
Glastonbury, CT 06033

Attn: Mr. Jesse Harris
P: (860) 652 8227
E: jharris@bscgroup.com

Re: Geotechnical Engineering Report
Athletic Field Renovations
Avon, Connecticut
Terracon Project No. J2165145

Dear Mr. Harris:

Terracon Consultants, Inc. (Terracon) is submitting, herewith, the results of our geotechnical evaluation for the above-referenced project. The purpose of this evaluation was to obtain information on subsurface conditions at the project site and, based on this information, to provide recommendations regarding the design and construction of foundations and site development for the proposed athletic field renovations.

We appreciate the opportunity to be of service on this project. If you have questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Brian D. Opp, P.E.
Project Geotechnical Engineer

Lawrence J. Dwyer, P.E.
Principal

/bdo/J2165145

Attachment

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APPENDIX A – FIELD EXPLORATION

Exhibit A-1	Site Location Map
Exhibit A-2	Exploration Location Diagram
Exhibit A-3	Field Exploration Description
Exhibits A-4 to A-10	Exploration Logs B-1 through B-5, P-1, and P-2

APPENDIX B – LABORATORY TESTING

Exhibit B-1	Laboratory Testing
Exhibits B-2 and B-3	Grain Size Distribution Test Results (Glaciofluvial Deposit)

APPENDIX C – SUPPORTING DOCUMENTS

Exhibit C-1	General Notes
Exhibit C-2	Unified Soil Classification System

EXECUTIVE SUMMARY

A geotechnical engineering report has been completed for the proposed athletic field renovations in Avon, Connecticut. Five test borings (B-1 through B-5) and two test probes (P-1 and P-2) were advanced to depths ranging from about 5 to 22 feet below existing grade to provide geotechnical information. The following geotechnical considerations for project design and construction were identified and are discussed in the report:

- The site is generally underlain by loose to very dense sand with gravel and occasional to frequent cobbles and boulders (glaciofluvial deposit). However fill was encountered to depths ranging of about 2.5 to 12.0 feet below the existing ground surface within the central to eastern portions of the site.
- The proposed athletic field light poles may be supported on precast or cast-in-place concrete piers extending into the glaciofluvial deposit.
- Proposed retaining walls and athletic field may derive support from either the native glaciofluvial sands or the existing fill after following the recommendations contained in this report.
- Site Class “D” may be used for seismic design purposes.
- Groundwater was encountered in four of the explorations at depths ranging from about 15 to 20 feet below the existing ground surface at the time of the explorations.
- Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. We therefore recommend Terracon be retained to monitor this portion of the work.

This summary should be used in conjunction with the entire report for design purposes. Details are not included or fully developed in this summary; the report must be read in its entirety of a comprehensive understanding of the information contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
ATHLETIC FIELD RENOVATIONS
510 WEST AVON ROAD
AVON, CONNECTICUT

Terracon Project No. J2165145
November 2, 2016

1.0 INTRODUCTION

The geotechnical engineering report for renovations to the athletic field in Avon, Connecticut (see Exhibit A-1, Site Location Map) has been completed. Five borings (B-1 through B-5) were advanced to depths of about 17 to 22 feet below existing ground surface. Two probes (P-1 and P-2) were advanced to depths of about 5 feet. Individual exploration logs and an Exploration Location Diagram (Exhibit A-2) are included in Appendix A. This report describes the subsurface conditions encountered in the test borings and provides a discussion of geotechnical considerations and recommendations for construction of the new athletic field.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- earthwork
- foundation design and construction
- seismic considerations
- retaining wall design
- athletic field subgrade preparation

2.0 PROJECT INFORMATION

Our understanding of the project comes from our recent discussions and review of your drawing set titled “Avon High School Athletic Facility”, Job No. 83572.01, dated July 20, 2016. A summary of the project is presented below:

Item	Description
Site Layout	Appendix A, Exhibit A-2, Exploration Location Diagram
Structures	Field Lights, retaining walls, synthetic turf athletic field.
Grading	Minor cuts and fills up to about a foot, or so, are anticipated for the renovations to the athletic field. Cuts of up to 6 feet, or so, are anticipated within the northeast portion of the site.
Free Standing Retaining Walls	Modular block walls, anticipated to range from about 2 to 7 feet in height, are anticipated within the northeast portion of site.

2.2 Site Location and Description

Item	Description
Location	510 West Avon Road, located southwest of Avon High School, in Avon, Connecticut.
Existing Improvements	Track and field in the center of site surrounded by associated lawn and paved access ways. Paved parking lot to the northeast of the site.
Current Ground Cover	Bituminous concrete / topsoil.
Existing Topography	Track and field is relatively level and is approximately 6 feet, or so, lower than adjacent parking area to the northeast.

The 2015 USGS topographic quadrangles for Collinsville and Avon, Connecticut depict the 270-foot ground surface elevation contour (NAVD 1988) traversing the center of the site from northwest to southeast.

3.0 SUBSURFACE EXPLORATIONS AND CONDITIONS

3.1 Typical Profile

Based on the results of the borings and observations at the time of drilling, subsurface conditions at the project site can be generalized as follows:

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Encountered [1]	Consistency / Relative Density
1 [2]	2.5 to 12.0	Poorly graded sand with gravel, frequent cobbles and boulders to silty sand, gray to brown (Fill)	Medium dense to very dense
2	>22	Sand with varying amounts of silt and gravel, occasional cobbles and boulders (SP, SP-SM, SM), gray to brown (Glaciofluvial Deposit)	Typically medium dense to dense

1. Topsoil (about 3 to 9 inches in thickness) was encountered at the surface of B-1 through B-4, P-1, and P-2. Bituminous concrete (about 3 inches in thickness) underlain by gravel base (about 6 inches in thickness) were encountered at the surface of B-5.
2. Fill was encountered in B-4, B-5, P-1, and P-2.

The *Surficial Materials Map of Connecticut (1992)* identifies the soil at the site as a glaciofluvial deposit. However, Fill (likely associated with site development) was encountered at the surface of B-4, B-5, P-1, and P-2. The encountered fill was observed to be about 2.5 feet below the

existing ground surface in the vicinity of P-1 and P-2 in the center of the athletic field and gradually increases on thickness to a depth of about 12 feet in the vicinity of B-5 closest to the parking area. Based on our review of the boring data, as well as our experience in this region, it is our opinion that Stratum 2 is consistent with the mapped glaciofluvial soils as indicated in the table above.

The *Bedrock Geological Map of Connecticut, 1985*, indicates the bedrock underlying the site, at depth, consists of arkose. However, bedrock was not encountered in our explorations. The explorations terminated without refusal in the glaciofluvial deposit at depths of about 5 to 22 feet.

Conditions encountered at each boring location are indicated on the individual boring logs in Appendix A of this report. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; *in situ*, the transition between materials may be gradual. Further details of the borings can be found on the boring logs.

3.2 Groundwater

Groundwater was encountered at depths of about 15 to 20 feet at the time of our explorations. However, fluctuations in groundwater level may occur because of seasonal variations in the amount of rainfall, runoff, and other factors. Additionally, grade adjustments on and around the site, as well as surrounding drainage improvements, may affect the water table. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

Boring Number	Depth to Groundwater while Sampling (ft.)
B-1	20
B-2	17
B-3	15
B-4	20

3.3 Laboratory Testing

Laboratory testing, consisting of a two moisture content determinations (ASTM D2216) and two grain size distribution tests (ASTM D422), was performed on representative samples of the glaciofluvial deposit recovered from B-2 and B-3. The moisture content is included on the individual boring log in Appendix A. The grain size distribution tests are presented in Appendix B.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

Based on our review of the exploration data obtained for this project, it is our opinion that the subsurface conditions are suitable for the following recommendations:

- The proposed field lights may be supported on precast or cast-in-place concrete piers extending into the native glaciofluvial deposit.
- The proposed masonry block retaining walls may derive support from the native glaciofluvial sands. The walls may derive support from the existing fill provided that a limited volume of fill is overexcavated and replaced with compacted structural fill as outlined in this report.
- The athletic field may derive support from the existing fill, provided it is compacted as outlined in this report, or on the native glaciofluvial sand.

Support of the retaining wall and athletic field on existing fill soils is discussed in this report. Even with the recommended construction testing services, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by performing additional testing and evaluation.

We recommend the excavated subgrades be evaluated after excavation to proposed grade. We recommend a qualified geotechnical engineer be retained to evaluate the bearing material for the foundation subgrade soils. Design recommendations are presented in the following sections.

4.2 Earthwork

4.2.1 Site Preparation

Bituminous concrete, topsoil, organic subsoil (subsoil with visible roots), and otherwise unsuitable or organic materials should be removed prior to placing fill. The subgrade should be proofrolled with at least six passes of a minimum 10-ton (static weight) vibratory roller compactor. Unstable material at subgrade level should be removed and replaced with compacted structural fill. Minus ¾-inch crushed stone may be used in place of structural fill. Fill, if required, may be placed to attain grade.

4.2.2 Material Types

Fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Structural Fill [2]	GW, GW-GM, SW, SW-SM, SP, GP	All locations and elevations. Existing fill and native glaciofluvial deposit may be selectively re-used as structural fill, provided they are close to meeting the requirements in Note 2 (below). Imported material for use as structural fill should meet the gradation requirements in Note 2. Cobbles and boulders should be culled from the fill prior to re-use.
Common Fill [3]	Varies	Common fill may be used for general site grading. Common fill should not be used under settlement or frost-sensitive structures. The existing fill and glaciofluvial deposit may be re-used as common fill, provided they can be adequately compacted. Cobbles and boulders should be culled from the fill prior to re-use.
Crushed Stone	GP	For use on wet subgrades and as drainage fill. Should be uniform ¾-inch angular crushed stone.
Lean Concrete	Not applicable	Can be used to level subgrades between foundations and native soils. Lean concrete should be flowable, self-compacting concrete with a compressive strength between 300 and 2,000 psi.

1. Compacted fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used. Fill should not be placed on a frozen subgrade.
2. Imported structural fill should meet the following gradation:

Percent Passing by Weight

Sieve Size	Structural Fill
6″	100
3″	70 – 100
2″	(100)*
¾″	45 – 95
No. 4	30 – 90
No. 10	25 – 80
No. 40	10 – 50
No. 200	0 – 12

* Maximum 2-inch particle size within 12 inches of the underside of foundations

3. Common fill should have a maximum particle size of 6 inches and no more than 25 percent by weight passing the US No. 200 sieve.

4.2.3 Compaction Requirements

Item	Description
Fill Lift Thickness	8 inches or less in loose thickness
Compaction Requirements [1]	95 percent maximum modified Proctor dry density (ASTM D1557, Method C)
Moisture Content – Granular Material	Workable moisture levels

1. We recommend that fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested, as required, until the specified moisture and compaction requirements are achieved.

4.2.4 Utility Trench Backfill

Trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. As utility trenches can provide a conduit for groundwater flow, trenches should be backfilled with material that approximately matches the permeability characteristics of the surrounding soil. Should higher permeability fill be used in trenches, consideration should be given to installing seepage collars and/or check dams to reduce the likelihood of migration of water through the trenches. Fill placed as backfill for utilities located below the slab should consist of compacted structural fill or suitable material.

4.2.5 Grading and Drainage

We anticipate permanent soil slopes will be required to develop the east side of the site, proximal to the retaining wall. Soil slopes should be designed at 3H:1V. Steeper grades, up to 2H:1V, may be feasible for slopes of limited height, but should be reviewed by the geotechnical engineer prior to final design.

Permanent fill and cut slope surfaces should be vegetated, or covered with an erosion mat, to protect against erosion. Temporary sedimentation and erosion control methods should be implemented during construction and left in place until the slope surface has been permanently stabilized.

Adequate drainage should be provided at the site to reduce the likelihood of an increase in moisture content of the foundation soils. Surface drainage, if required, would likely consist of swales to control runoff.

4.2.6 Earthwork Construction Considerations

Although the exposed subgrade is anticipated to be relatively stable upon initial exposure, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Should unstable subgrade conditions develop, stabilization measures will need to be employed.

Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, wet, or disturbed, the affected material should be removed, or should be scarified, moisture conditioned, and recompacted.

As a minimum, temporary excavations should be sloped or braced, as required by Occupational Safety and Health Administration (OSHA) regulations, to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations, as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, State, and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; backfilling of excavations in the completed subgrade; and just prior to construction of foundations.

4.3 Foundation Recommendations

We recommend proposed light poles be supported on precast or cast-in-place concrete piers. The proposed modular retaining walls should be supported on either the native glaciofluvial sand or on a 12-inch thickness of structural fill over the existing fill. The surface of the exposed existing fill subgrade should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. The athletic field may derive support from the existing fill. Design recommendations and construction considerations for the recommended foundation systems are presented below:

4.3.1 Light Pole Foundation Design Recommendations

The individual lighting structures may be supported on precast or cast-in-place concrete piers deriving support from the glaciofluvial deposit. Design recommendations are presented in the following table and paragraph:

Description	Value
Net Allowable Bearing Pressure [1]	
Glaciofluvial Deposit (3.5 to 6 feet)	3 ksf
Glaciofluvial Deposit (>6 feet)	5 ksf
Ultimate Side Friction [2,3]	1 ksf
Allowable Lateral Bearing Pressure	150 psf/ft
Estimated *In-situ* Soil Unit Weight	125 pcf

Description	Value
Approximate Groundwater Depth	15 to 20 feet
Concrete Minimum 28-day Unconfined Compressive Strength [3]	4,000 psi

1. The allowable end bearing pressure assumes that loose soil at the base of the foundation has been removed and that the base has not been disturbed.
2. Value is for interaction between precast concrete piers and soil. Not applicable for cast-in-place concrete in cardboard sonotubes.
3. Contribution to shaft capacity from material above a depth of 42 inches should be ignored. The uplift capacity of the shaft will be based on side friction and the dead weight of the shaft.
4. Air entraining admixtures should be used for concrete exposed to freezing.

4.3.2 Light Pole Foundation Construction Considerations

The shaft for the light pole foundations should be aligned vertically. Soil placed around the precast or cast-in-place foundations should be systematically compacted in lifts. Concrete, if poured, should be placed by directing the concrete down the center of the shaft in order to reduce the likelihood of hitting the reinforcing steel and segregating. Groundwater, if encountered, should be removed prior to placing concrete.

4.3.3 Retaining Wall Foundation Design Recommendations

Based on our explorations, a limited amount of fill is anticipated beneath the proposed retaining walls within the northeast portion of the site. In the vicinity of B-5, the fill is likely to extend to a depth of 5 to 6 feet below the existing ground surface.

We consider the existing fill to be unsuitable for direct support of the proposed retaining wall in its current condition. However to reduce some of the uncertainty of leaving fill in place we recommend over excavating at least 12 inches below the leveling pad and replacing the old fill with structural fill. The lateral limits of the structural fill should extend at least 12 inches from either side of the leveling pad. As added improvement to the old fill, we recommend compacting the old fill subgrade to at least 95 percent of the maximum dry density as determined by ASTM D1557.

4.3.4 Retaining Wall Foundation Construction Considerations

If unsuitable bearing soils are encountered in the excavation, the excavation should be extended deeper to suitable soils. The overexcavation should then be backfilled up to the wall base elevation with structural fill placed in lifts of 8 inches or less in loose thickness and compacted to at least 95 percent of the modified Proctor maximum dry density (ASTM D1557, Method C).

Groundwater was encountered at a depth of about 15 to 20 feet below the existing ground surface at the time of our explorations. We do not anticipate that significant dewatering will be required during construction of the gravity wall foundation. However, the contractor should be required to maintain a stable subgrade during construction. The contractor should prevent groundwater, if

encountered, and surface water runoff from collecting in the excavation. Subgrade soils that become unstable because of water and/or reworking by construction activity should be replaced with compacted structural fill or minus ¾-inch crushed stone, as necessary.

The predominant material at the anticipated subgrade level will be the existing fill, portions of which may have an elevated silt content. Soil with a higher silt content will be sensitive to excess moisture and lose strength quickly during wet periods. Contractors experienced in earthwork construction in this area should be aware of the silty soil behavior and the effect that moisture and inclement weather can have on its workability. If a contractor bids construction knowing that earthwork must begin during the winter or wet months, the contractor should include a contingency in his bid to use off-site suitable fill, and to remove and dispose of on-site soils that become unsuitable.

4.4 Seismic Considerations

Description	Value
Code Used [1]	Connecticut State Building Code (CBC)
Site Class [2]	D
Seismic Design Category [3]	B
Maximum Considered Earthquake Ground Motions (5 percent damping) [4]	0.064g (1.0 second spectral response acceleration)
	0.181g (0.2 second spectral response acceleration)
Liquefaction Potential in Event of an Earthquake	Not susceptible

1. The CBC incorporates the Seismic Design Category approach of the 2015 International Building Code (IBC).
2. The CBC uses a site soil profile determination extending a depth of 100 feet for seismic site classification. The current scope requested does not include a 100-foot soil profile determination. However, we expect soil as dense as that encountered above a depth of about 22 feet will extend to at least 100 feet.
3. Appendix R of the 2012 IBC portion of the 2016 CBC.
4. Appendix N of the 2012 IBC portion of the 2016 CBC.

4.5 Lateral Earth Pressures

The modular block retaining wall should be designed by the wall supplier/manufacturer. We recommend the retaining wall designer utilize a total unit weight of 125 pcf and friction angle of 30 degrees for the retained soil, as well as the following considerations:

- Uniform area surcharges behind the wall should be accounted for where they are located within a horizontal distance behind the wall equal to 1.5 times the height of the wall.
- Surcharge stresses due to point loads, line loads, and those of limited extent, such as compaction equipment, should be evaluated using elastic theory.
- To account for the effect of compaction equipment on the wall during construction, the lateral pressure should not be less than 200 psf, distributed uniformly over the height of the wall.
- Backfill compacted to 95 percent of modified Proctor maximum dry density, except within 4 feet of back of wall, which should be compacted to 92 percent of modified Proctor maximum dry density with hand operated equipment.
- Heavy compaction equipment should not operate within a distance closer than the exposed height of retaining wall.
- Surcharge due to water pressure may be neglected if geotextile wrapped foundation drains are installed behind and at the base of the retaining walls with a collection pipe leading to a reliable discharge.
- Retaining structures should be backfilled evenly to the extent practical.
- Dynamic loading should be considered in accordance with state building code.
- Passive pressure should be ignored.

Backfill placed against the retaining wall should consist of granular soils. The granular backfill should extend out from the base of the wall at an angle of at least 45 from vertical. To calculate the resistance to sliding, a value of 0.5 should be used as the ultimate coefficient of friction between the footing and the underlying soil.

To control hydrostatic pressure behind the wall, we recommend a drain be installed at the level of the wall foundation with a collection pipe leading to a reliable discharge. Where appropriate, a swale should be constructed behind the retaining wall to direct surface run-off away from the wall.

4.6 Athletic Field

The athletic field should be designed by the turf supplier/manufacturer. Topsoil, organic subsoil (subsoil with visible roots), and otherwise unsuitable or organic materials should be removed prior to placing the athletic field base material. The subgrade should be proofrolled with at least six passes of a minimum 5-ton (static weight) vibratory roller compactor. Unstable material at subgrade level should be replaced with compacted structural fill. Minus ¾-inch crushed stone may be used in place of structural fill. When subgrade preparation has been completed to the satisfaction of the geotechnical engineer, base material meeting the specifications of the athletic field designer should then be placed to attain the proper grade.

5.0 GENERAL COMMENTS

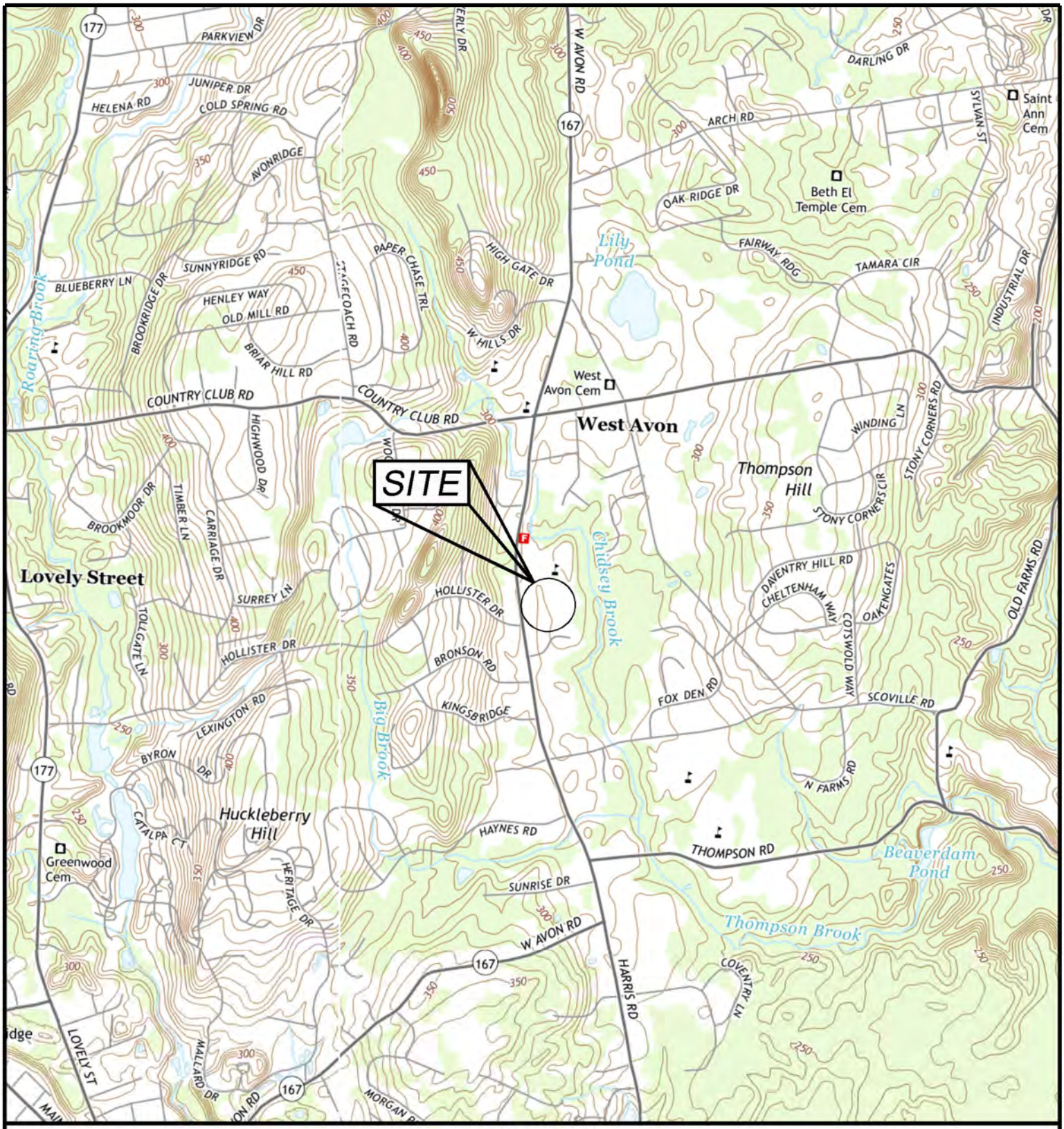
Terracon should be retained to review the final design plans and specifications, so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction, and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the explorations performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between explorations, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions.

This report has been prepared for the exclusive use of the client for specific application to the project discussed and prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION



Project Mngr:	BDO
Drawn By:	JCH
Checked By:	BDO
Approved By:	LJD

Project No.:	J2165145
Quadrangle:	COLLINSVILLE, CT - 2015 AVON, CT - 2015
File No.	J2165145.dwg
Date:	October 2016

Terracon
Consulting Engineers and Scientists
201 Hammer Mill Road Rocky Hill, CT 06067
PH. (860)721 1900 FAX.(860)721 1939

SITE LOCATION MAP

ATHLETIC FIELD RENOVATIONS

510 WEST AVON ROAD
AVON, CONNECTICUT

EXHIBIT
A-1

80 0 40 80

APPROXIMATE SCALE IN FEET

LEGEND

B-1 TEST BORING LOCATION (TYP)

P-1 TEST PROBE LOCATION (TYP)

NOTES:

1. THIS DIAGRAM WAS PREPARED BASED ON A "*GRADING AND DRAINAGE PLAN*" BY BSC GROUP OF GLASTONBURY, CONNECTICUT, JOB No. 83572.01, SHEET No. SF-4.0, DATED JULY 20, 2016, AND AVAILABLE AERIAL PHOTOGRAPHY.
2. THE EXPLORATIONS B-1 THROUGH B-5, P-1, AND P-2 WERE ADVANCED ON SEPTEMBER 26, 2016.
3. THE APPROXIMATE LOCATIONS OF THE EXPLORATIONS WERE TAPED FROM SITE FEATURES. THE LOCATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
4. USE OF THIS DIAGRAM IS LIMITED TO THE ILLUSTRATION OF THE APPROXIMATE LOCATIONS OF THE EXPLORATIONS AND OTHER PERTINENT SITE FEATURES. ANY OTHER USE OF THIS DIAGRAM WITHOUT PERMISSION FROM TERRACON IS PROHIBITED.

Project Mngr:	BDO
Drawn By:	JCH
Checked By:	BDO
Approved By:	LJD
Project No:	J2165145
Scale:	1" = 80'
File No:	J2165145.dwg
Date:	October 2016

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EXPLORATION LOCATION DIAGRAM

ATHLETIC FIELD RENOVATIONS

510 WEST AVON ROAD

AVON, CONNECTICUT

EXHIBIT

A-2

Field Exploration Description

Terracon monitored the advancement of five test borings (B-1 through B-5) and two test probes (P-1 and P-2) on September 26, 2016. B-1 through B-5 were advanced using an all-terrain vehicle mounted Diedrich D-50 rotary drill rig using 3¼-inch inside diameter continuous flight hollow-stem augers. P-1 and P-2 were advanced using hand augers. The approximate exploration locations, which are shown on Exhibit A-2, were taped from existing site features and by estimating right angles. Ground elevations at the exploration locations were estimated by interpolating between contours of existing grades shown on the *"Grading and Drainage Plan"*, Drawing No. SF-4.0, Job No. 83572.01, dated July 20, 2016, by BSC Group of Glastonbury, Connecticut. Ground surface elevations rounded to the nearest foot are shown on the individual exploration logs in Appendix A. The locations of the explorations as well as the elevations should be considered accurate only to the degree implied by the method used to define them.

In the split-barrel sampling procedure, which was used to take soil samples in the test borings, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler typically the middle 12 inches of the total 24-inch penetration by means of a 140-pound autohammer with a free fall of 30 inches is the Standard Penetration Test (SPT) resistance value "N". This "N" value is used to estimate the *in-situ* relative density of cohesionless soils and consistency of cohesive soils.

An automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

The soil samples were placed in labeled glass jars and taken to our laboratory for further review and classification by a Terracon geotechnical engineer. Information provided on the exploration logs attached to this report includes soil descriptions, relative density and/or consistency evaluations, exploration depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings and the bituminous pavement repaired with "cold patch" asphalt, where appropriate, prior to the drill crew leaving the site.

Field logs of the explorations were prepared by a Terracon field engineer. These logs included visual classifications of the materials encountered during the explorations as well as interpretation by our field engineer of the subsurface conditions between samples. Final exploration logs included with this report represent further interpretation by the geotechnical engineer of the field logs and incorporate, where appropriate, modifications based on laboratory classification and testing of the samples.

BORING LOG NO. B-1

PROJECT: Athletic Field Renovations

CLIENT: BSC Group, Inc.
Glastonbury, Connecticut

SITE: 510 West Avon Road
Avon, Connecticut

LOCATION See Exhibit A-2

Approximate Surface Elev: 276 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.8	275+/-						
TOPSOIL							
POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), occasional cobbles and boulders, gray to brown, loose to dense, **(GLACIOFLUVIAL DEPOSIT)**					18	5-9-8-6 N=17	
					14	5-6-5-6 N=11	
		5					
					14	3-4-5-6 N=9	
					17	6-8-10-11 N=18	
NOTE: Cobbles and boulders encountered between 10 and 12'.		10					
					15	10-17-27-33 N=44	
		15					
					22	10-11-11-13 N=22	
17.0	259+/-						
SILTY SAND WITH GRAVEL (SM), brown, medium dense, **(GLACIOFLUVIAL DEPOSIT)**							
		20	▽				
					10	4-6-6-9 N=12	
22.0	254+/-						
Boring Terminated at 22 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with 2" outside-diameter split spoon sampler driven by an autohammer.

Advancement Method:
3 1/4-inch inside diameter continuous flight hollow-stem augers.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *20 feet while sampling.*

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 9/26/2016 | Boring Completed: 9/26/2016
Drill Rig: Diedrich D-50 | Driller: C. Johnston
Project No.: J2165145 | Exhibit: A-4

BORING LOG NO. B-2

PROJECT: Athletic Field Renovations

CLIENT: BSC Group, Inc.
Glastonbury, Connecticut

SITE: 510 West Avon Road
Avon, Connecticut

LOCATION See Exhibit A-2

Approximate Surface Elev: 275 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
	0.5 **TOPSOIL**	274.5+/-						
	POORLY GRADED SAND WITH SILT (SP-SM), gray to brown, medium dense to dense, **(GLACIOFLUVIAL DEPOSIT)**				X	16	5-7-8-9 N=15	
					X	12	8-8-10-11 N=18	4
			5					
					X	20	7-8-10-22 N=18	
					X	24	13-15-16-15 N=31	
			10					
					X	24	5-7-9-9 N=16	
			15	▽				
					X	17	7-8-5-6 N=13	
	17.0	258+/-						
	SILTY SAND (SM), brown, medium dense, **(GLACIOFLUVIAL DEPOSIT)**							
	NOTE: Clay lens encountered at 20'.		20		X	24	3-6-9-13 N=15	
	22.0	253+/-						
	Boring Terminated at 22 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with 2" outside-diameter split spoon sampler driven by an autohammer.

Advancement Method:
3 1/4-inch inside diameter continuous flight hollow-stem augers.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *17 feet while sampling.*

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 9/26/2016 | Boring Completed: 9/26/2016
Drill Rig: Diedrich D-50 | Driller: C. Johnston
Project No.: J2165145 | Exhibit: A-5

BORING LOG NO. B-3

PROJECT: Athletic Field Renovations

CLIENT: BSC Group, Inc.
Glastonbury, Connecticut

SITE: 510 West Avon Road
Avon, Connecticut

LOCATION See Exhibit A-2

Approximate Surface Elev: 275 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.5 **TOPSOIL**	274.5+/-						
POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), gray to brown, medium dense to dense, **(GLACIOFLUVIAL DEPOSIT)**					12	4-6-7-8 N=13	
					20	9-9-12-10 N=21	8
		5			22	8-10-10-8 N=20	
					24	20-20-28-30 N=48	
		10			24	9-13-17-25 N=30	
			▽				
		15			24	6-7-8-13 N=15	
17.0	258+/-						
POORLY GRADED SAND WITH GRAVEL (SP), brown, loose, **(GLACIOFLUVIAL DEPOSIT)**		20			22	3-3-4-6 N=7	
22.0	253+/-						
Boring Terminated at 22 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with 2" outside-diameter split spoon sampler driven by an autohammer.

Advancement Method:
3 1/4-inch inside diameter continuous flight hollow-stem augers.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *15 feet while sampling.*

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 9/26/2016 | Boring Completed: 9/26/2016
Drill Rig: Diedrich D-50 | Driller: C. Johnston
Project No.: J2165145 | Exhibit: A-6

BORING LOG NO. B-4

PROJECT: Athletic Field Renovations

CLIENT: BSC Group, Inc.
Glastonbury, Connecticut

SITE: 510 West Avon Road
Avon, Connecticut

LOCATION See Exhibit A-2

Approximate Surface Elev: 276 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
	0.5	275.5+/-						
TOPSOIL								
FILL - POORLY GRADED SAND to SILTY SAND, brown					X	10	6-8-10-12 N=18	
	3.0	273+/-			X	14	10-9-10-9 N=19	
POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), occasional cobbles, brown, medium dense to very dense, **(GLACIOFLUVIAL DEPOSIT)**			5		X	8	13-6-4-4 N=10	
NOTE: Cobbles encountered at 7.5'.					X	8	21-50/5"	
			10		X	16	9-14-17-17 N=31	
	17.0	259+/-	15		X	16	8-10-7-6 N=17	
POORLY GRADED SAND WITH GRAVEL (SP), brown, medium dense, **(GLACIOFLUVIAL DEPOSIT)**			20	▽	X	18	7-8-12-10 N=20	
	22.0	254+/-						
Boring Terminated at 22 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with 2" outside-diameter split spoon sampler driven by an autohammer.

Advancement Method:
3 1/4-inch inside diameter continuous flight hollow-stem augers.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *20 feet while sampling.*

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 9/26/2016 | Boring Completed: 9/26/2016
Drill Rig: Diedrich D-50 | Driller: C. Johnston
Project No.: J2165145 | Exhibit: A-7

BORING LOG NO. B-5

PROJECT: Athletic Field Renovations

CLIENT: BSC Group, Inc.
Glastonbury, Connecticut

SITE: 510 West Avon Road
Avon, Connecticut

LOCATION See Exhibit A-2

Approximate Surface Elev: 282 (Ft.) +/-

DEPTH		ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.3	**BITUMINOUS CONCRETE**	281.5+/-						
0.8	**GRAVEL BASE**	281+/-						
	FILL - POORLY GRADED SAND WITH GRAVEL, occasional to frequent cobbles and boulders, gray to brown					12	9-10-9-10 N=19	
						8	11-17-22-21 N=39	
			5			2	50/2"	
12.0		270+/-	10			6	11-18-19-22 N=37	
	POORLY GRADED SAND (SP), gray to brown, dense, **(GLACIOFLUVIAL DEPOSIT)**							
			15			19	9-14-17-20 N=31	
17.0		265+/-						
	Boring Terminated at 17 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with 2" outside-diameter split spoon sampler driven by an autohammer.

Advancement Method:
3 1/4-inch inside diameter continuous flight hollow-stem augers.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS
No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 9/26/2016 | Boring Completed: 9/26/2016
Drill Rig: Diedrich D-50 | Driller: C. Johnston
Project No.: J2165145 | Exhibit: A-8

BORING LOG NO. P-1

PROJECT: Athletic Field Renovations

CLIENT: BSC Group, Inc.
Glastonbury, Connecticut

SITE: 510 West Avon Road
Avon, Connecticut

LOCATION See Exhibit A-2

Approximate Surface Elev: 277 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG
0.3	276.5+/-	**TOPSOIL**
		FILL - SILTY SAND, brown
2.5	274.5+/-	
		POORLY GRADED SAND WITH SILT, brown, **(GLACIOFLUVIAL DEPOSIT)**
5.0	272+/-	
		Boring Terminated at 5 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
5					

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
2-inch diameter hand auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
Boring advanced to depth using hand auger.

WATER LEVEL OBSERVATIONS
No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 9/26/2016	Boring Completed: 9/26/2016
Drill Rig: N/A	Driller: C. McGinness
Project No.: J2165145	Exhibit: A-9

BORING LOG NO. P-2

PROJECT: Athletic Field Renovations

CLIENT: BSC Group, Inc.
Glastonbury, Connecticut

SITE: 510 West Avon Road
Avon, Connecticut

LOCATION See Exhibit A-2

Approximate Surface Elev: 276 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**	275.5+/-						
	FILL - SILTY SAND, brown							
	2.5	273.5+/-						
	POORLY GRADED SAND WITH SILT, brown, **(GLACIOFLUVIAL DEPOSIT)**							
	5.0	271+/-	5					
	Boring Terminated at 5 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
2-inch diameter hand auger

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:
Boring advanced to depth using hand auger.

WATER LEVEL OBSERVATIONS
No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 9/26/2016 | Boring Completed: 9/26/2016
Drill Rig: N/A | Driller: C. McGinness
Project No.: J2165145 | Exhibit: A-10

APPENDIX B
LABORATORY TESTING

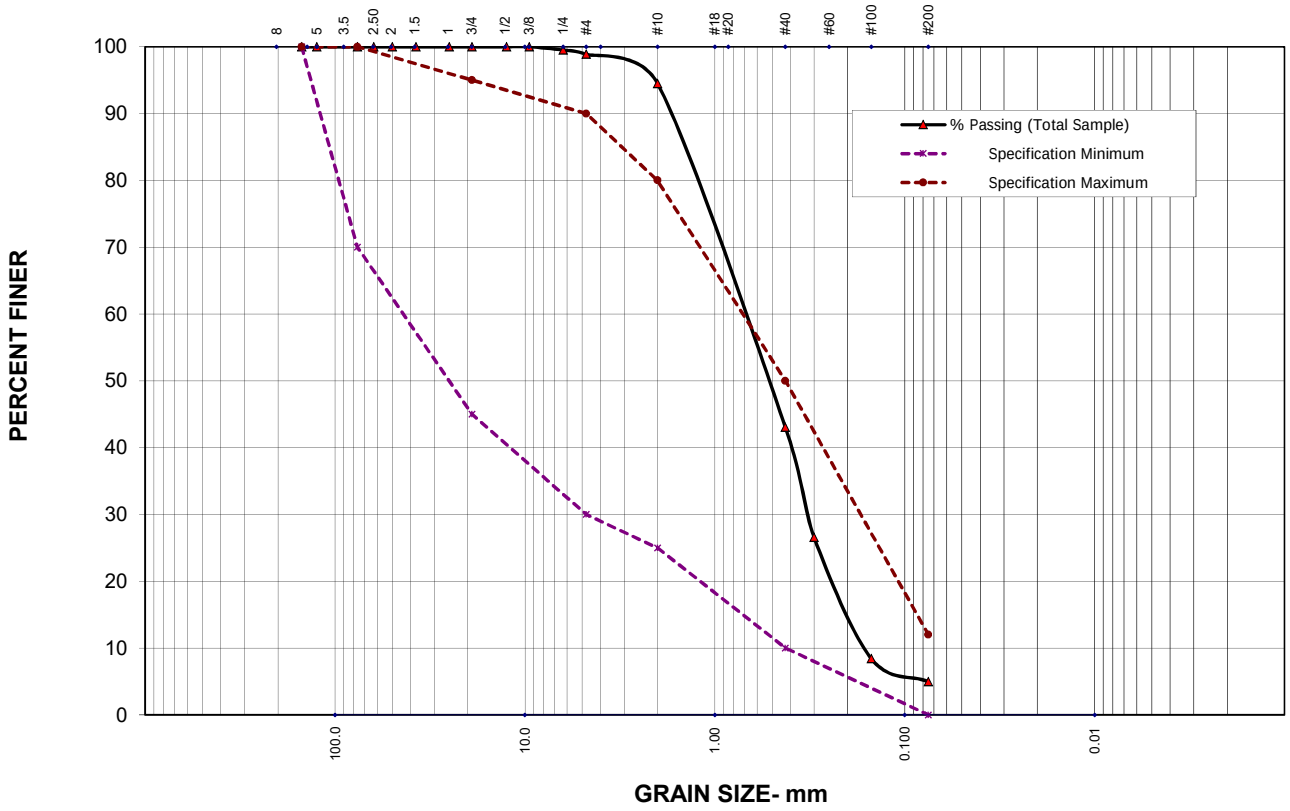
LABORATORY TESTING SUMMARY

Descriptive classifications of the soils indicated on the exploration logs are in accordance with the enclosed General Notes, and the Unified Soil Classification System (USCS). USCS symbols are also shown. A brief description of the USCS is attached to this report. Classification was generally by visual/manual procedures aided by the results of the laboratory testing.

Laboratory testing, consisting of two moisture content determinations (ASTM D2216) and two grain size distribution tests (ASTM D422), was performed on a representative samples of the glaciofluvial deposit recovered from test borings B-2 and B-3. The moisture content is included on the individual boring log in Appendix A. The grain size distribution test is presented in this appendix.

GRAIN SIZE DISTRIBUTION TEST REPORT

ASTM TEST METHOD: D422



% Cobbles	% Gravel	Coarse	Medium	Fine	% Fines	
		4.7	54.8	40.5	Silt (>0.002mm)	Clay (<0.002mm)
0	1		% Sand	94	5	

USCS Classification: Poorly graded sand with silt (SP-SM), gray to brown

Sieve Size (mm)	U.S. Sieve Size (in.)	Cumulative Wt. Retained	% Passing (Total Sample)	% Passing (Sand Portion)	Specification Minimum	Specification Maximum
150.0	6"	0.00	100		100	100
125.0	5"	0.00	100			
76.3	3"	0.00	100		70	100
62.5	2.5"	0.00	100			
50.0	2"	0.00	100			
37.5	1.5"	0.00	100			
25.0	1"	0.00	100			
19.0	3/4"	0.00	100		45	95
12.5	1/2"	0.00	100			
9.5	3/8"	0.00	100			
6.3	1/4"	1.38	100			
4.75	#4	3.17	99		30	90
2.00	#10	15.52	94		25	80
0.425	#40	160.14	43		10	50
0.300	#50	206.39	27			
0.150	#100	257.40	8			
0.075	#200	267.10	5		0	12

Total Dry Wt. 281.08 g
Moisture Content 3.5 %

Project:	**Athletic Field Renovations**	Project No.:	**J2165145**	Date:	**11/2/2016**
City:	Avon, Connecticut	Specification:	Terracon Structural Fill	Report No:	J2165145.0001
Source:	B-2	Sampled from:	2 to 4 feet (Glaciofluvial deposit)		

Terracon

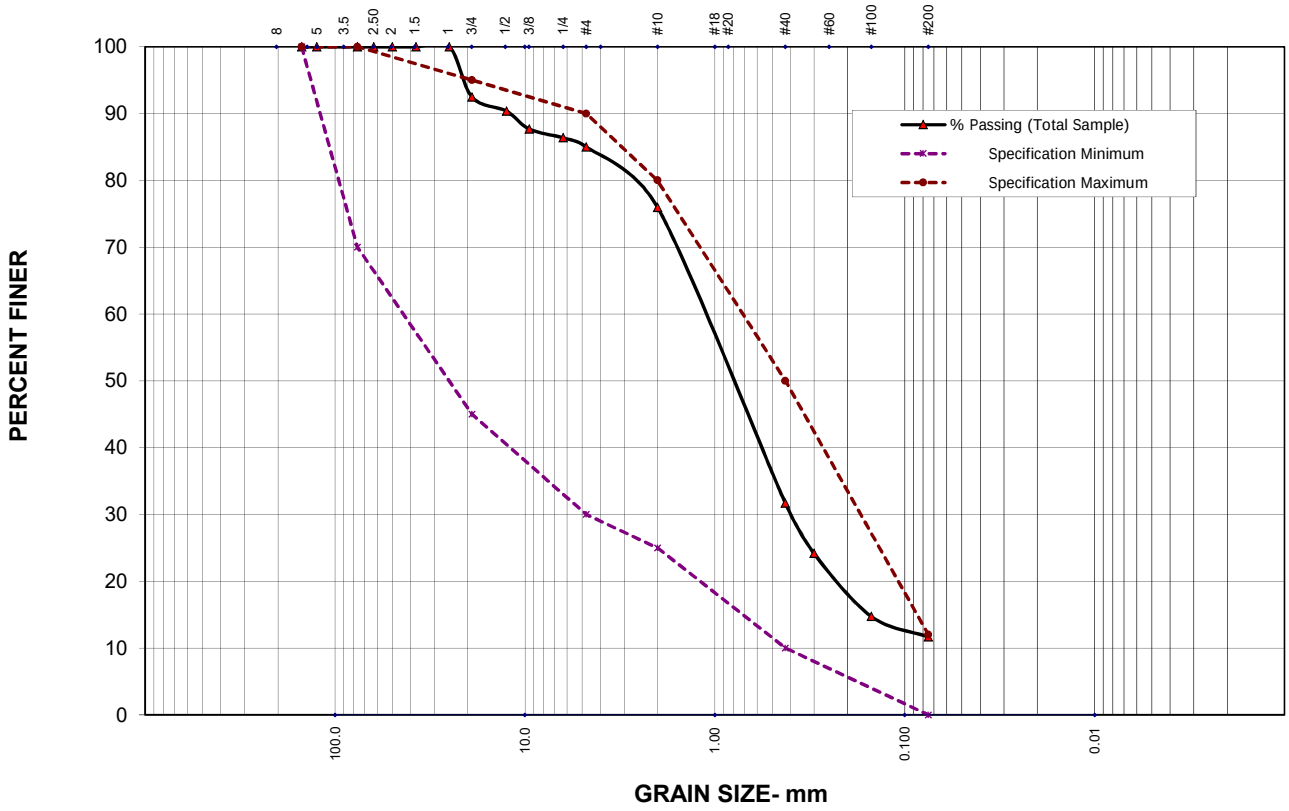
201 Hammer Mill Road
Rocky Hill, CT 06067
860-721-1900 (p) 860-721-1939 (f)
http://www.terracon.com/

Remarks:

Tested By: C. Klopfer Date: 10/6/2016
Reviewed By: *BDO* Date: 10/6/2016

GRAIN SIZE DISTRIBUTION TEST REPORT

ASTM TEST METHOD: D422



% Cobbles	% Gravel	Coarse	Medium	Fine	% Fines	
		12.3	60.3	27.3	Silt (>0.002mm)	Clay (<0.002mm)
0	15	% Sand		73	12	

USCS Classification: Poorly graded sand with silt and gravel (SP-SM), gray to brown

Sieve Size (mm)	U.S. Sieve Size (in.)	Cumulative Wt. Retained	% Passing (Total Sample)	% Passing (Sand Portion)	Specification Minimum	Specification Maximum
150.0	6"	0.00	100		100	100
125.0	5"	0.00	100			
76.3	3"	0.00	100		70	100
62.5	2.5"	0.00	100			
50.0	2"	0.00	100			
37.5	1.5"	0.00	100			
25.0	1"	0.00	100			
19.0	3/4"	19.40	92		45	95
12.5	1/2"	24.82	90			
9.5	3/8"	31.70	88			
6.3	1/4"	35.11	86			
4.75	#4	38.65	85		30	90
2.00	#10	61.95	76		25	80
0.425	#40	175.91	32		10	50
0.300	#50	195.37	24			
0.150	#100	219.60	15			
0.075	#200	227.54	12		0	12

Total Dry Wt. 257.58 g
Moisture Content 7.6 %

Project:	**Athletic Field Renovations**	Project No.:	**J2165145**	Date:	**11/2/2016**
City:	Avon, Connecticut	Specification:	Terracon Structural Fill	Report No:	J2165145.0002
Source:	B-3	Sampled from:	2 to 4 feet (Glaciofluvial deposit)		

Terracon

201 Hammer Mill Road
Rocky Hill, CT 06067
860-721-1900 (p) 860-721-1939 (f)
http://www.terracon.com/

Remarks:

Tested By: C. Klopfer Date: 10/6/2016
Reviewed By: *BDO* Date: 10/6/2016

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING


Auger


Split Spoon


Shelby Tube


Macro Core


Ring Sampler


Rock Core


Grab Sample


No Recovery

WATER LEVEL


Water Initially Encountered


Water Level After a Specified Period of Time


Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, psf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

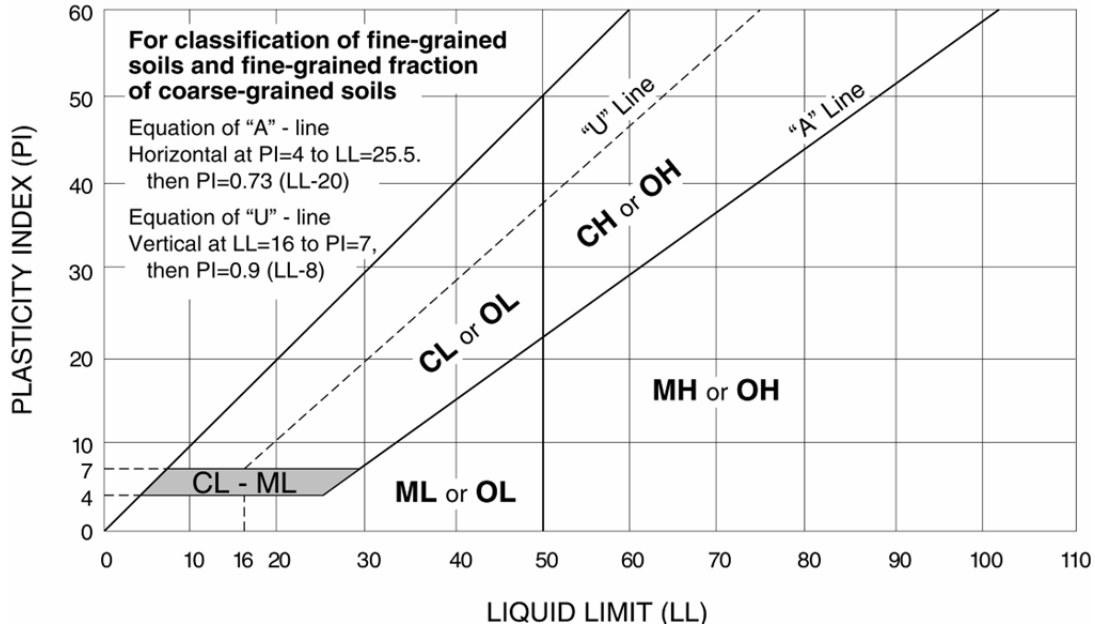
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

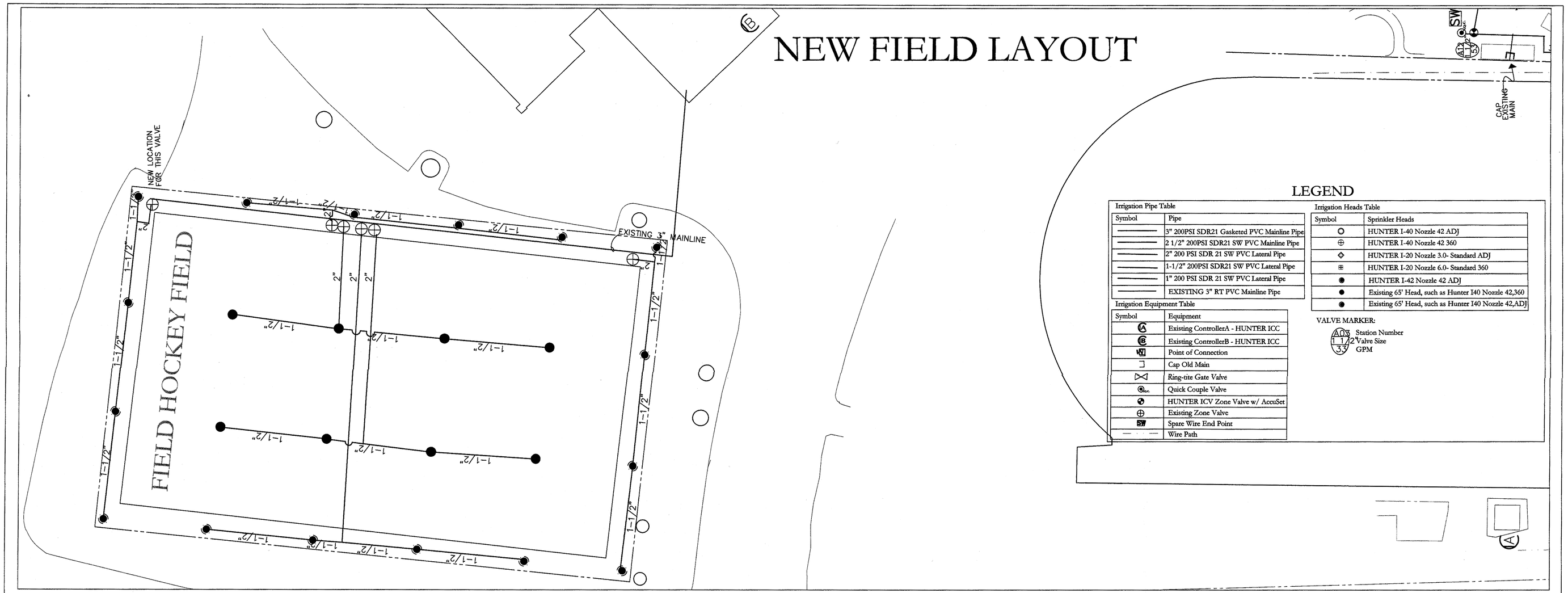
[Q] PI plots below "A" line.



Terracon

Exhibit C-2

NEW FIELD LAYOUT



LEGEND

Irrigation Pipe Table

Symbol	Pipe
	3" 200PSI SDR21 Gasketed PVC Mainline Pipe
	2 1/2" 200PSI SDR21 SW PVC Mainline Pipe
	2" 200 PSI SDR 21 SW PVC Lateral Pipe
	1-1/2" 200PSI SDR21 SW PVC Lateral Pipe
	1" 200 PSI SDR 21 SW PVC Lateral Pipe
	EXISTING 3" RT PVC Mainline Pipe

Irrigation Heads Table

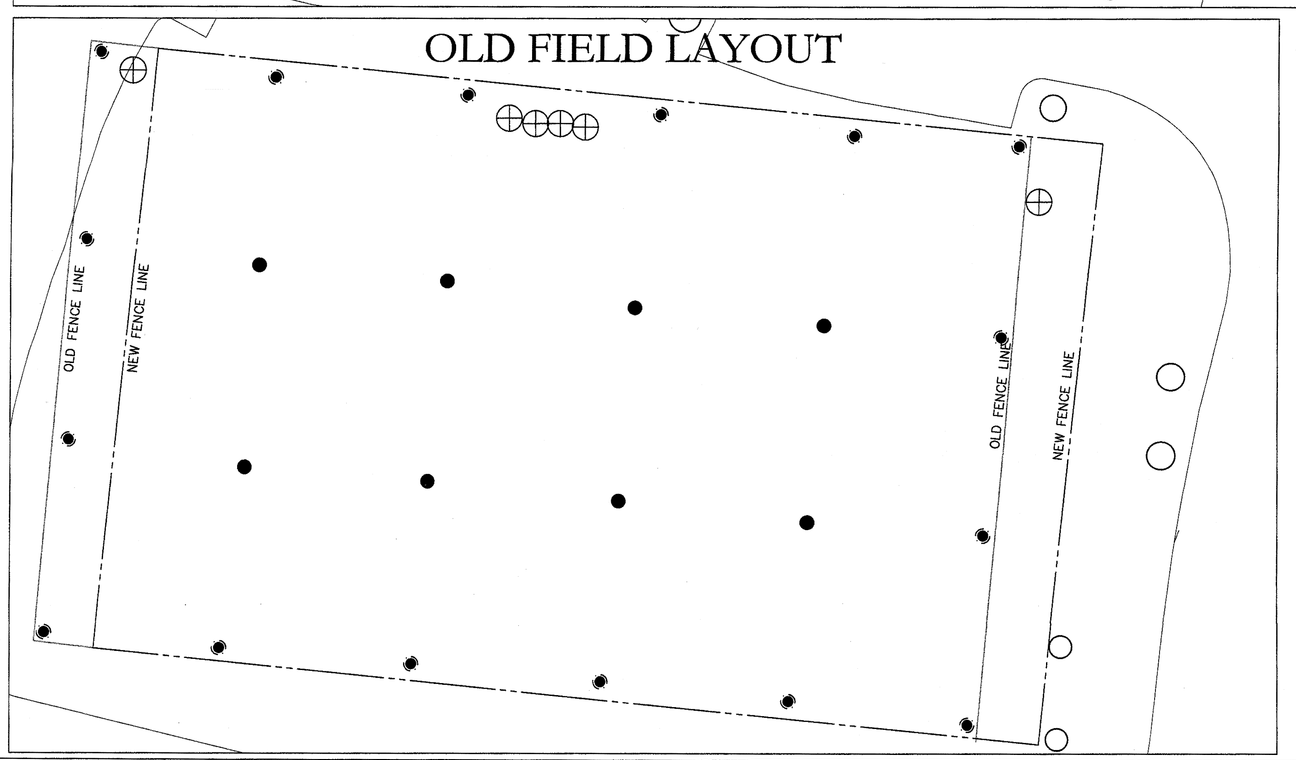
Symbol	Sprinkler Heads
	HUNTER I-40 Nozzle 42 ADJ
	HUNTER I-40 Nozzle 42 360
	HUNTER I-20 Nozzle 3.0- Standard ADJ
	HUNTER I-20 Nozzle 6.0- Standard 360
	HUNTER I-42 Nozzle 42 ADJ
	Existing 65' Head, such as Hunter I40 Nozzle 42,360
	Existing 65' Head, such as Hunter I40 Nozzle 42,ADJ

Irrigation Equipment Table

Symbol	Equipment
	Existing ControllerA - HUNTER ICC
	Existing ControllerB - HUNTER ICC
	Point of Connection
	Cap Old Main
	Ring-tite Gate Valve
	Quick Couple Valve
	HUNTER ICV Zone Valve w/ AccuSet
	Existing Zone Valve
	Spare Wire End Point
	Wire Path

VALVE MARKER:
A03 Station Number
1 2 Valve Size
33 GPM

OLD FIELD LAYOUT



NOTES:

Existing field is being moved approximately 25'
see old and new fence lines
Use "Old Field Layout" to find Existing Heads and Valve Boxes
Re-Pipe all zones
Re-Use all existing heads, swing joints and valve assemblies
Relocate zone valve marked on plan as moved and any other zone valves needed to keep out of play
All wire connections shall be made in a valve box and marked on as-built drawings, and shall be made with waterproof UL listed DBY splice connectors

KAESTLE BOOS associates, inc

416 Slater Road, P.O. Box 2590, New Britain, CT 06050-2590
Phone: 860-229-0361 ▲ Fax: 860-229-5303

325 Foxborough Boulevard, Suite 100, Foxborough, MA 02035
Phone: 508-549-9906 ▲ Fax: 508-549-9907

Pease International Tradeport, One New Hampshire Avenue, Suite 125, Portsmouth, NH 03801
Phone: 603-766-1965 ▲ Fax: 603-766-4965

Email: kba@kba-architects.com ▲ Web: www.kba-architects.com

Anderson Irrigation Design
4 ADIRONDACK LANE
GUILFORD, CT 06437
PHONE: 203-453-1377
FAX: 203-453-1377

RENOVATIONS AND ADDITIONS TO AVON HIGH SCHOOL

510 WEST AVON ROAD
AVON, CONNECTICUT

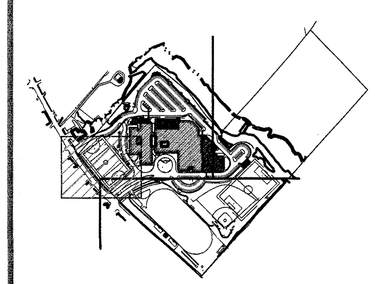
STATE PROJECT NO. 004-0062 EA/RR

ISSUE DATE

DATE	DESCRIPTION
09/13/2005	DRAWINGS ISSUED FOR SCHEMATIC DESIGN
12/05/2005	DRAWINGS ISSUED FOR OSF REVIEW
05/17/2006	DRAWINGS ISSUED FOR BID AND CONSTRUCTION PURPOSES

REVISIONS

DATE	MARK	DESCRIPTION



KEY PLAN

DRAWN BY: WA
CHECKED BY:

SCALE: 1"=30'-0"

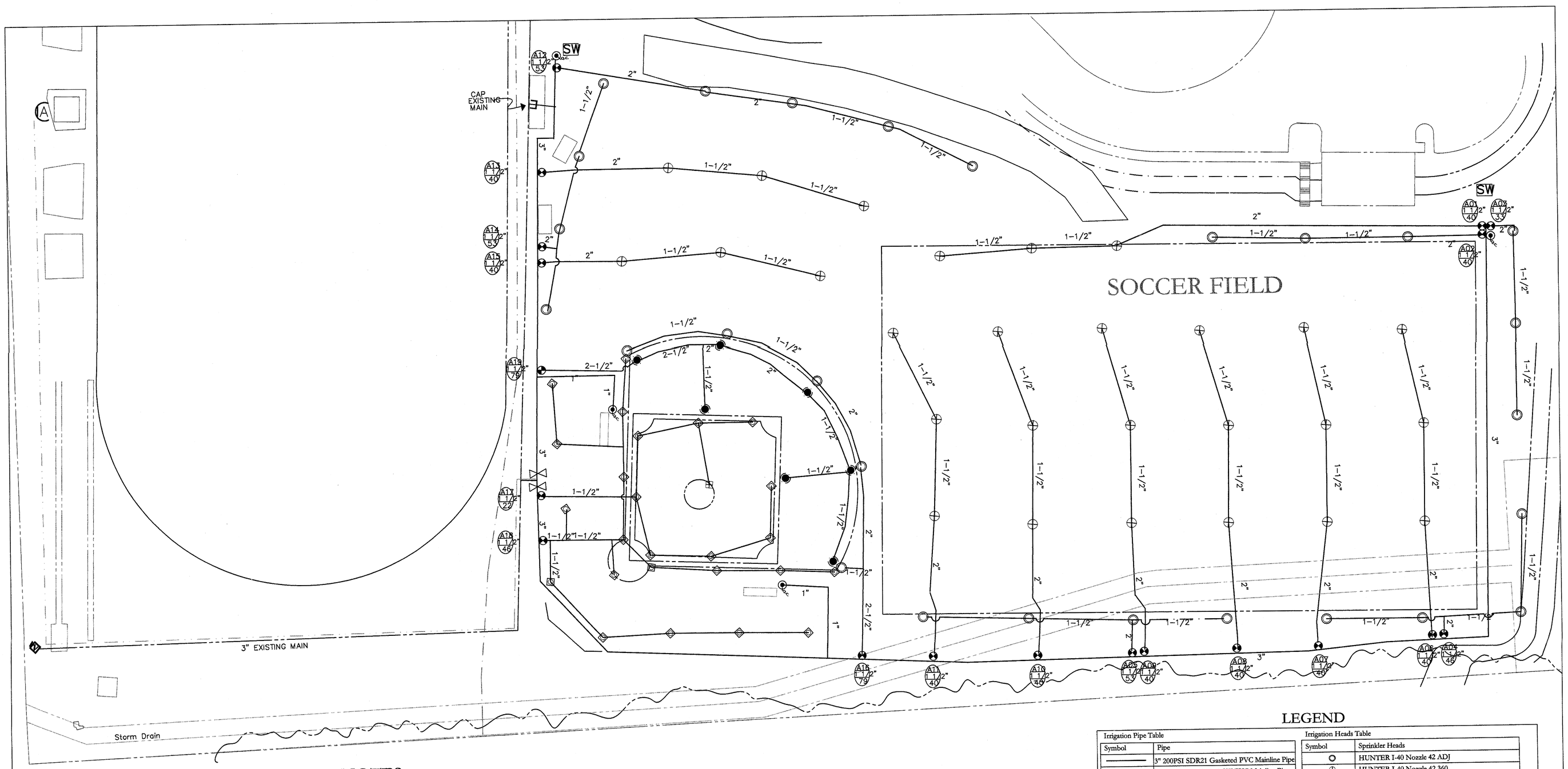
SITE IRRIGATION PLAN

PROJECT NO.: 04027.01

DRAWING NO.:

DATE: NOVEMBER 29, 2005

IR1.02



NOTES:

All wire connections shall be made in a valve box and marked on as-built drawings, and shall be made with waterproof UL listed DBY splice connectors
All heads next to skinned area shall be placed 6" off of clay
All heads next to warning track shall be placed 12" off of track
Storm Drain is buried 4-6' deep

LEGEND

Irrigation Pipe Table

Symbol	Pipe
———	3" 200PSI SDR21 Gasketed PVC Mainline Pipe
———	2 1/2" 200PSI SDR21 SW PVC Mainline Pipe
———	2" 200 PSI SDR 21 SW PVC Lateral Pipe
———	1-1/2" 200PSI SDR21 SW PVC Lateral Pipe
———	1" 200 PSI SDR 21 SW PVC Lateral Pipe
———	EXISTING 3" RT PVC Mainline Pipe

Irrigation Heads Table

Symbol	Sprinkler Heads
○	HUNTER I-40 Nozzle 42 ADJ
⊕	HUNTER I-40 Nozzle 42 360
◇	HUNTER I-20 Nozzle 3.0- Standard ADJ
⊞	HUNTER I-20 Nozzle 6.0- Standard 360
●	HUNTER I-42 Nozzle 42 ADJ
●	Existing 65' Head, such as Hunter I40 Nozzle 42,360
●	Existing 65' Head, such as Hunter I40 Nozzle 42,ADJ

Irrigation Equipment Table

Symbol	Equipment
A	Existing ControllerA - HUNTER ICC
B	Existing ControllerB - HUNTER ICC
POC	Point of Connection
	Cap Old Main
	Ring-tite Gate Valve
QC	Quick Couple Valve
	HUNTER ICV Zone Valve w/ AccuSet
	Existing Zone Valve
SW	Spare Wire End Point
— —	Wire Path

VALVE MARKER:
Station Number
Valve Size
GPM

SYSTEM REQUIREMENTS:

95 GPM
120 PSI

KAESTLE BOOS associates, inc

416 Slater Road, P.O. Box 2590, New Britain, CT 06050-2590
Phone: 860-229-0361 ▲ Fax: 860-229-5303

325 Foxborough Boulevard, Suite 100, Foxborough, MA 02035
Phone: 508-549-9906 ▲ Fax: 508-549-9907

Pease International Tradeport, One New Hampshire Avenue, Suite 125, Portsmouth, NH 03801
Phone: 603-766-1965 ▲ Fax: 603-766-4965

Email: kba@kba-architects.com ▲ Web: www.kba-architects.com

Anderson Irrigation Design

4 ADIRONDACK LANE
GUILFORD, CT 06437
PHONE: 203-453-1377
FAX: 203-453-1377

RENOVATIONS AND ADDITIONS TO AVON HIGH SCHOOL

510 WEST AVON ROAD
AVON, CONNECTICUT

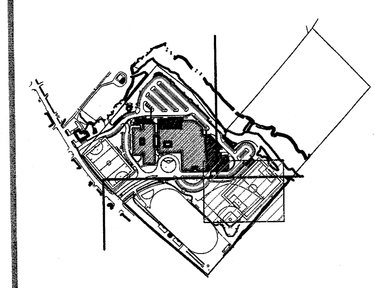
STATE PROJECT NO. 004-0062 EA/RR

ISSUE DATE

DATE	DESCRIPTION
09/13/2005	DRAWINGS ISSUED FOR SCHEMATIC DESIGN
12/05/2005	DRAWINGS ISSUED FOR OSF REVIEW
05/17/2006	DRAWINGS ISSUED FOR BID AND CONSTRUCTION PURPOSES

REVISIONS

DATE	MARK	DESCRIPTION



KEY PLAN

DRAWN BY: WA
CHECKED BY:

SCALE: 1"=30'-0"

SITE IRRIGATION PLAN

PROJECT NO.: 04027.01

DRAWING NO.: **IR1.01**

DATE: NOVEMBER 29, 2005

WEST AVON ROAD

CONN. ROUTE 167

N/F Avonridge, Inc.

N/F James McKenzie

N/F John F. & Nancy S. Carlson

N/F Avon Water Co.

Avon Volunteer Fire Company uses this portion of subject property. No improvements are shown on this parcel.

MATCH MARK TO SHEET 2

CREST REPROGRAPHICS
FIXED LINE MYLAR

Notes:

1. This survey has been prepared in accordance with the "Recommended Standards for Surveys and Maps in the State of Connecticut" as adopted for use by the Connecticut Association of Land Surveyors, Inc. on September 24, 1992.

2. The type of survey performed is a property survey and is intended to depict or note the position of boundaries with respect to apparent improvements, record easement lines, lines of occupation, deed restrictions and apparent boundary encroachments.

3. Boundary determination/opinion is based upon an independent Resurvey. Minor adjustments to the referenced boundary were made to reflect the measurments made with modern equipment.

4. This survey conforms to an A-2 class of accuracy.

5. Topographic features depicted hereon conform to a T-2 class of accuracy.

6. See sheet 2 for map references.

TO THE BEST OF MY KNOWLEDGE AND BELIEF THIS MAP IS SUBSTANTIALLY CORRECT AS NOTED HEREON.

JOHN W. DAVIS, P.E., L.S. CONN. LIC. NO. 15807

Notes:

1. A portion of this property is in Flood Insurance Zone A2. For additional information see map entitled: "National Flood Insurance Program, Floadway, Flood Boundary and Floodway Map, Town of Avon, Connecticut, Hartford County, Panel 5 of 8, Community-Panel Number 090021 0005, Map Revised June 17, 1986" by Federal Emergency Management Agency.

2. Underground utility locations depicted and noted hereon have been compiled, in part, from record mapping supplied by the respective utility companies or governmental agencies and from other sources. These locations must be considered as approximate in nature. Additionally, other such features may exist on the site, the existence of which are unknown to A-N Consulting Engineers, Inc. The size, location and existence of all such features must be field determined and verified by appropriate authorities prior to construction. Call before you dig 1-800-922-4455.

0 25 50 100 150 200
SCALE IN FEET

NO CERTIFICATION IS EXPRESSED OR IMPLIED ON THE ORIGINAL, OR ANY DUPLICATE OF THIS MAP, UNLESS IT BEARS THE LAND SURVEYOR IMPRESSION TYPE SEAL AND AN ORIGINAL SIGNATURE OF THE SURVEYOR WHOSE NAME AND LICENSE NUMBER APPEAR ON THIS MAP.

NO.	DATE	REVISIONS

A-N CONSULTING ENGINEERS
A-N Consulting Engineers, Inc.
505 Willard Avenue
Newington, Connecticut 06111
(860) 666-3366
FAX (860) 666-5163

3095

510 WEST AVON ROAD
AVON HIGH SCHOOL
4/1/21

BOUNDARY & TOPOGRAPHIC SURVEY

AVON HIGH SCHOOL
WEST AVON ROAD
AVON, CONNECTICUT

Designed By	
Drawn By	J.A.V.
Checked By	A.L.N.
Approved By	J.W.D.
PROJECT NO.	1391
DATE	JAN., 1995
SCALE	1" = 50'
SHEET NO.	1 of 2

1391PLOT.DWG

Ave. #3246