

2024-026- Attachment D

PROJECT MANUAL

IRMO ELEMENTARY PLAYGROUND DRAINAGE IMPROVEMENTS

DISTRICT FIVE OF
LEXINGTON & RICHLAND COUNTIES
IRMO, SOUTH CAROLINA

Prepared by

CHAO & ASSOCIATES, INC.
7 CLUSTERS COURT
COLUMBIA, SC 29210



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PROJECT DIRECTORY

OWNER: Steve Kane
SCHOOL DISTRICT 5 OF LEXINGTON AND RICHLAND COUNTIES
1020 DUTCH FORK ROAD
IRMO, SC 29063
TEL: (803) 476-8116
FAX: (803) 732-8047

CIVIL ENGINEER: GERALD A. LEE, P.E.
CHAO AND ASSOCIATES, INC.
7 CLUSTERS COURT
COLUMBIA, SC 29210
TEL: (803) 772-8420
FAX: (803) 772-9120

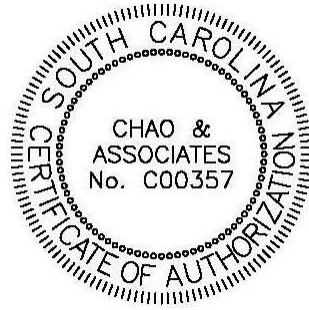
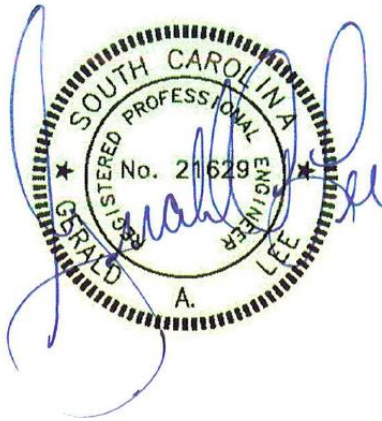


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IRMO ELEMENTARY PLAYGROUND DRAINAGE IMPROVEMENTS

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**AIA Document A701 - 1997,
“Instructions to Bidders”
Articles 1 through 8, Pages 1 through 6,**

is hereby made part of these documents.

An Original is on file in the Engineer’s Office located at:

Engineer: Chao and Associates, Inc.
7 Clusters Court
Columbia, South Carolina 29210

NOTE: The District’s “Instruction To Bidders”, included in the Bid Invitation, amend or supplement Instructions to Bidders (AIA Document A701-1997) and other provisions of Bidding and Contract Documents. All provisions of the A7011997, which are not so amended or supplemented, remain in full force and effect.

Irmo Elementary School Playground Drainage
School District 5 of Lexington and Richland Counties

**AIA Document A310 – 2010,
“Bid Bond”**

is hereby made part of these documents.

An Original is on file in the Engineer’s Office located at:

Engineer: Chao and Associates, Inc.
7 Clusters Court
Columbia, South Carolina 29210

Irmo Elementary School Playground Drainage
School District 5 of Lexington and Richland Counties

**AIA Document A101 - 2017,
Standard Form of Agreement Between Owner and Contractor
Articles 1 through 10, Pages 1 through 8,**

is hereby made part of these documents.

An Original is on file in the Engineer's Office located at:

Engineer: Chao and Associates, Inc.
7 Clusters Court
Columbia, South Carolina 29210

**AIA Document A201 - 2017,
“General Conditions of the Contract for Construction”
Articles 1 through 15, Pages 1 through 38,**

is hereby made part of these documents.

An Original is on file in the Engineer’s Office located at:

Engineer: Chao and Associates, Inc.
7 Clusters Court
Columbia, South Carolina 29210

NOTE: The District’s “General Provisions”, “General Conditions”, and Special Conditions”, included in the Bid Invitation, amend or supplement the General Conditions of the Contract for Construction (AIA Document A201-2017) and other provisions of Bidding and Contract Documents. All provisions of the A201-2017, which are not so amended or supplemented, remain in full force and effect.

**AIA Document A312 - 2010,
Performance Bond and Payment Bond
Pages 1 through 5**

is hereby made part of these documents.

An Original is on file in the Engineer's Office located at:

Engineer: Chao and Associates, Inc.
7 Clusters Court
Columbia, South Carolina 29210

Irmo Elementary School Playground Drainage
School District 5 of Lexington and Richland Counties

**AIA Document G701 - 2001,
Change Order
Pages 1**

is hereby made part of these documents.

An Original is on file in the Engineer's Office located at:

Engineer: Chao and Associates, Inc.
7 Clusters Court
Columbia, South Carolina 29210

SECTION 02050 - DEMOLITION, ABANDONMENT AND SALVAGE

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The Work specified in this Section includes furnishing all labor, materials, equipment and incidentals required to demolish, abandon, modify, remove, salvage, and dispose of Work shown on the Contract Drawings and as specified herein.
- B. Included, but not limited to, are demolition, modifications, abandonment, and removal of existing materials, equipment or Work necessary to install the new Work as shown on the Contract Drawings and as specified herein and to connect with existing Work in approved manner.
- C. Demolition, modifications and removals which may be specified under other Sections shall conform to requirements of this Section.
- D. All items designated on the Contract Documents to be removed and salvaged shall be turned over to the Owner and delivered to a site within the owners facilities as directed by the Owner. All items indicated for demolition but not indicated for salvage shall be disposed of by the Contractor.
- E. Blasting and the use of explosives will not be permitted for any work on this project.

1.2 RELATED WORK

- A. Section 01010, Summary of Work
- B. Section 01300, Submittals
- C. Section 02100, Site Preparation
- D. Section 02200, Earthwork

1.3 SUBMITTALS

- A. Submit to the Owner/Engineer, in accordance with Section 01300, proposed methods and operations of demolition of the structures and modifications prior to the start of Work. Include in the schedule the coordination of shutoff, capping and continuation of utility service as required.
- B. Furnish a detailed sequence of demolition and removal Work to ensure the uninterrupted progress of the Owner's operations. Sequence shall be compatible with sequence of construction and shutdown coordination requirements as specified in Section 01015, Work Sequence during Construction.

- C. Before commencing demolition Work, all modifications necessary to bypass the affected structure shall be completed. Actual Work shall not begin until the Owner/Engineer has inspected and approved the modifications and authorized commencement of the demolition Work in writing.

1.4 JOB CONDITIONS

A. Protection

1. Execute the demolition and removal Work to prevent damage or injury to structures, occupants thereof and adjacent features which might result from falling debris or other causes, and so as not to interfere with the use, and free and safe passage to and from adjacent structures.
2. Closing or obstructing of roadways, sidewalks and passageways adjacent to the Work by the placement or storage of materials will not be permitted and all operations shall be conducted with a minimum interference to traffic on these ways.
3. Erect and maintain barriers, lights, sidewalk sheds and other required protective devices.

B. Scheduling

1. Carry out operations so as to avoid interference with operations and Work in existing facilities.

C. Notifications

1. At least two weeks prior to commencement of any demolition or removal, confirm with the Owner/Engineer in writing of proposed schedule therefor. Owner/Engineer shall inspect the existing equipment and to identify and mark those Items which are to remain the property of the Owner. No removals shall be started without the permission of the Owner/Engineer.

D. Conditions of Structures

1. The Owner and the Engineer assume no responsibility for the actual condition of the structures to be demolished or modified.
2. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations within a structure may occur prior to the start of demolition Work.

E. Repairs to Damage

1. Promptly repair damage caused to adjacent facilities by demolition operation when directed by Owner/Engineer and at no cost to the Owner. Repairs shall be made to a condition at least equal to that which existed prior to construction.

F. Traffic Access

1. Conduct demolition and modification operations and the removal of equipment and debris to ensure minimum interference with roads, streets, walks both onsite and offsite and to ensure minimum interference with occupied or used facilities.
2. Special attention is directed towards maintaining safe and convenient access to the existing facilities by the Operations staff and associated vehicles.
3. Do not close or obstruct streets, walks or other occupied or used facilities without permission from the Owner/Engineer. Furnish alternate routes around closed or obstructed traffic in access ways.

1.5 DISPOSAL OF MATERIAL

- A. Salvageable material and equipment noted on the Contract Drawings shall become the property of the Owner at their option, otherwise it becomes property of the Contractor and Contractor will be responsible for proper disposal. Dismantle all such items to a size that can be readily handled and deliver them to a designated storage area as directed by the Owner/Engineer. Any such material damaged due to improper handling will not be accepted and the replacement value of the material deducted from the payment to the Contractor.
- B. All other material and Items of equipment shall become the Contractor's property and must be removed from the site and be disposed of properly.
- C. The storage or sale of removed Items on the site will not be allowed.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 GENERAL

- A. All materials and equipment removed from existing Work shall become the property of the Contractor, except for those which the Owner has identified and marked for his/her use. All materials and equipment marked by the Owner to remain shall be carefully removed, so as not to be damaged, cleaned, protected and delivered to a place specified by the Owner/Engineer.
- B. Dispose of all demolition materials, equipment, debris and all other Items not marked by the Owner to remain, off the site and in conformance with all existing applicable laws and regulations. The Owner/Engineer must approve any plans to reuse the material at another location.

C. Pollution Controls

1. Use water sprinkling, temporary enclosures and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
 - a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding and pollution.
 - b. Clean adjacent structures, facilities, and general Work area of dust, dirt and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the Work.

3.2 STRUCTURAL REMOVALS

- A. Structures designated for demolition or removal shall be removed to a point 2 feet below existing grade, or greater if required to provide clearance for new pipelines or other utilities, including allowance for pipe/utility bedding. The portion of the structure that will remain below grade shall be cleaned of rubble and debris including exposed reinforcing steel, backfilled with Type A material in accordance with specification Section 02200 (Earthwork) and graded to match the existing grade around the structure. All mechanical and electrical equipment and piping shall be removed from those structures prior to backfilling and grading.

3.3 ABANDONMENT OF EXISTING PIPING AND MANHOLES

- A. Existing piping and manholes designated for abandonment shall be removed from service, dewatered, and filled with flowable fill concrete. Where existing piping and manholes are in active service by the Owner, the Contractor shall coordinate with Owner/Engineer to ensure all services have been relocated and/or abandoned prior to decommissioning of pipe and/or manhole. Provide the Owner ten (10) days notification prior to abandonment of existing piping and manholes.

3.4 CLEAN-UP

- A. Remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the Work, all materials, equipment, waste and debris of every sort shall be removed and premises shall be left, clean, neat and orderly.

END OF SECTION 02050

SECTION 02068 - EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY: Work outlined in this section includes:

- A. Installation of silt barriers such as silt fence.
- B. Installation of rock check dams.
- C. Seeding for the purpose of slope stabilization or erosion control.
- D. Installation of rip-rap for slope stabilization.
- E. Removal of erosion control devices.

1.2 REFERENCED STANDARDS

- A. South Carolina State Department of Transportation (SCDOT): Standard Specification for Highway Construction, 2007 Edition.
- B. South Carolina Code of Regulations, Chapter 72, Article 2 (Erosion & Sediment Reduction & Stormwater Management Regulations)
- C. Guide to Site Development and Best Management Practices for Storm Water Management and Sediment Control (SCLRCC).

1.3 SUBMITTALS

- A. Proposed materials to be employed, for siltation control and preventing erosion damage shall be submitted for approval. Submittals shall include a list of proposed materials including manufacturer's product data.

1.4 EROSION CONTROL PRINCIPLES: The following erosion control principles shall apply to the land grading and construction phases:

- A. Stripping of vegetation, grading, or other soil disturbance shall be done in a manner which will minimize soil erosion.
- B. Whenever feasible, natural vegetation shall be retained and protected.
- C. Extent of area which is exposed and free of vegetation shall be kept within practical limits.
- D. Temporary seeding, mulching, or other suitable stabilization measures shall be used to protect exposed critical areas during prolonged construction or other land disturbance.

- E. Drainage provisions shall accommodate increased runoff resulting from modifications of soil and surface conditions during and after development or disturbance. Such provisions shall be in addition to existing requirements.
- F. Sediment shall be retained on-site.
- G. Erosion control devices shall be installed as early as possible in the construction sequence prior to start of clearing and grubbing operations and excavation work.
- H. Cut and fill slopes and stockpiled materials shall be protected to prevent erosion. Slopes shall be protected with permanent erosion protection when erosion exposure period is expected to be greater than or equal to two (2) weeks, and temporary erosion protection when erosion exposure period is expected to be less than two (2) weeks.
- I. Permanent erosion protection shall be accomplished by seeding with grass and covering with an erosion protection material, as appropriate for prevailing conditions.
- J. Temporary erosion protection shall be accomplished by covering with erosion protection materials, as appropriate for prevailing conditions.
- K. Except where specified slope is indicated on Drawings, fill slopes shall be limited to a grade of 2:1 (horizontal: vertical) cut slopes shall be limited to a grade of 1.5:1.

1.5 SECTION DESCRIPTION: Provide all equipment and materials, and do all work necessary to construct a complete erosion and sediment control program for minimizing erosion and siltation during the construction phase of the project. The Contractor shall provide additional erosion and sediment control materials and methods as required to affect the erosion and siltation control principles specified herein.

PART 2 - PRODUCTS:

2.1 SILT FENCE: Silt fence shall be a wire-bound woodroll snow fence covered with filter fabric. Fence shall be 2 ft. high minimum, and shall have 3/8 in. by 1-1/2 in. wide pickets, approximately 2 in. apart, bound together with at least 13 gage minimum, galvanized steel wire.

- A. Filter fabric shall be one of the following, or approved equal:

<u>Product</u>	<u>Manufacturer</u>
MIRAFI Silt Fence	MIRAFI, Charlotte, NC 28224

- B. Silt fence shall be supported by steel posts, driven a minimum of 18 inches. into the ground. Posts shall be spaced 6 ft. o.c. maximum.
- C. Fencing other than that specified above shall be subject to review and acceptance by the Engineer.

2.2 TEMPORARY SEED COVER: Grass seed for temporary seed cover shall be previous year's crop. Not more than 0.5% by weight shall be weed seed and not more than 1.75% by weight crop seed. Seed shall be delivered to site in sealed containers, labeled with name of seed grower and seed formula, in form stated below. Seed shall be dry and free of mold. Seed shall meet the requirements of SCDOT Standard Specifications Sections 810.03 and 810.04 for temporary vegetation.

A. Seed for temporary seed cover shall conform to the following requirements:

- 1 All seed must meet the requirements of the state seed laws including the labeling requirements for showing pure live seed, (PLS - purity x germination), name and type of seed.
- 2 Seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within nine months of the time of use on the project. Each variety of seed shall be furnished and delivered in separate bags or containers.
- 3 A sample of each variety of seed shall be furnished for analysis and testing when directed by the Architect/Engineer. The amount and type of seed planted per acre shall be as specified below.
- 4 All seed shall be treated with fungicide approved by the Engineer.
- 5 Seed application rate shall conform to SCDOT Standard Specifications Section 810.04.

2.3 RIP-RAP: Rip-rap shall consist of hard quarry of field stone and shall be of such quality that it will be resistant to exposure to the action of water and air. Stone shall consist of well graded mixture of 6" to 8" stone.

2.4 CHECK DAM: Check dams may be placed in swale and ditch sections to reduce velocities and erosion. Check dams shall consist of 12 inch or hand placed sized rip rap. The Contractor shall place the stone at locations shown on the plans and in other areas as approved by the Engineer where erosion occurs. The check dams shall be cleaned and otherwise maintained by the Contractor on a regular basis.

PART 3 - EXECUTION

3.1 TEMPORARY SEED COVER: Grass seed shall be spread by mechanical spreader at the specified rate. Following seeding, area shall be lightly raked to mingle seed with the top 1/8 to 1/4 in. of soil. Areas shall then be smoothed and rolled.

A. Following rolling, entire area shall be watered until equivalent of a 2 in. depth of water has been applied to entire seeded surface, at a rate which will not dislodge seed. Watering shall be repeated thereafter as frequently as required to prevent drying of surface, until grass attains an average height of 1-1/2 in.

- B. At the Contractor's option, seed may be spread by the hydroseeding method, utilizing power equipment commonly used for that purpose. Seed and mulch shall be mixed and applied to achieve application quantities specified herein for the conventional seeding method, with mulch applied at the rate of 2700 lb. dry weight of mulch per acre. A mulching machine, acceptable to the Engineer, shall be equipped to eject the thoroughly wet mulch material at a uniform rate to provide the mulch coverage specified. Other provisions specified above for conventional seeding shall apply to hydroseeding.
 - 1 If the results of hydroseeding application are unsatisfactory, the mixture and/or application rate and methods shall be modified to achieve the required results.
 - 2 After the grass has appeared, all areas and parts of areas which fail to show a uniform stand of grass, for any reason whatsoever, shall be re-seeded and such areas and parts of areas seeded repeatedly until all areas are covered with a satisfactory growth of grass.
- 3.2 SILT FENCE: Silt fence shall be constructed and installed as shown on the plans, prior to start of clearing and grubbing operations.
- 3.3 MAINTENANCE AND REMOVAL OF EROSION CONTROL DEVICES: Wetland areas, water courses, and drainage swales adjacent to construction activities shall be monitored twice each month for evidence of silt intrusion and other adverse environmental impacts, which shall be corrected immediately upon discovery.
- 3.4 CULVERTS AND DRAINAGE DITCHES: shall be kept clean and clear of obstructions during construction period.
- 3.5 EROSION CONTROL DEVICES:
- A. Sediment behind the erosion control device shall be checked twice each month and after each heavy rain. Silt shall be removed if greater than 6 in. deep.
 - B. Condition of erosion control device shall be checked twice each month or more frequently as required. Damaged and/or deteriorated items shall be replaced. Erosion control devices shall be maintained in place and in effective condition.
 - C. Hay bales shall be inspected frequently and maintained or replaced as required to maintain both their effectiveness and essentially their original condition. Underside of bales shall be kept in close contact with the earth below at all times, as required to prevent water from washing beneath bales.
 - D. Sediment deposits shall be disposed of off-site, in a location and manner which will not cause sediment nuisance elsewhere.

3.6 REMOVAL OF EROSION CONTROL DEVICES:

- A. Erosion control devices shall be maintained until all disturbed earth has been paved or vegetated, at which time they shall be removed. After removal, areas disturbed by these devices shall be re-graded and seeded.
- B. Erosion protection material shall be kept securely anchored until acceptance of completed slope or entire Project, whichever is later.

END OF SECTION 02068

SECTION 02100 - SITE PREPARATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The Work specified in this Section includes furnishing all labor, materials and equipment required and performing all site preparation, complete as shown on the Contract Drawings and as specified herein.
- B. Obtain all permits required for site preparation Work prior to proceeding with the Work, including clearing and tree removal.
- C. The areas to be cleared, grubbed and stripped within public rights-of-way and utility easements shall be minimized to the extent possible for the scope of Work and in consideration of the actual means and methods of construction used. No unnecessary site preparation within these areas shall be performed. No tree shall be removed unless specified, shown on the Contract Drawings or with prior permission of the Owner.
- D. Contractor shall contact the appropriate regulatory authority and the Owner to review and approve any trees to be cut prior to starting any cutting.

1.2 RELATED WORK

- A. Section 02050, Demolition, Abandonment and Salvage
- B. Section 02200, Earthwork
- C. Section 02930, Loaming, Seeding and Sodding

1.3 SUBMITTALS

- A. Submit to the Owner/Engineer, in accordance with Section 01300, copies of all permits required prior to clearing and grubbing work.
- B. The proposed site for the disposal of material and debris from the site preparation shall be submitted for approval to the Owner/Engineer.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 CLEARING

- A. Cut and remove all timber, trees, stumps, brush, shrubs, roots, grass, weeds, rubbish and any other objectionable material resting on or protruding through the surface of the ground.
- B. Preserve and protect trees and other vegetation designated on the Contract Drawings or directed by the Owner/Engineer to remain as specified below.

3.2 GRUBBING

- A. Grub and remove all stumps, roots in excess of 1-1/2-in in diameter, matted roots, brush, timber, logs, concrete rubble and other debris encountered to a depth of 18-in below original grade or 18-in beneath the bottom of foundations, whichever is deeper.
- B. Refill all grubbing holes and depressions excavated below the original ground surface with suitable materials and compact to a density conforming to the surrounding ground surface in accordance with Section 02200.

3.3 STRIPPING

- A. Strip topsoil from all areas to be occupied by buildings, structures, and roadways and all areas to be excavated or filled.
- B. Topsoil shall be free from brush, trash, large stones and other extraneous material. Avoid mixing topsoil with subsoil.
- C. Stockpile and protect topsoil until it is used in landscaping, loaming and seeding operations. Dispose of surplus topsoil after all Work is completed.

3.4 DISPOSAL

- A. Cut tree trunks and limbs exceeding 4-in in diameter shall be cut into 4-ft lengths and stockpiled on site in the area designated on the Contract Drawings or approved by the Owner/Engineer.
- B. Dispose of material and debris from site preparation operations by hauling such materials and debris to an approved offsite disposal area. No rubbish or debris of any kind shall be buried on the site.
- C. Burning of cleared and grubbed materials or other fires for any reason will not be permitted.

3.5 PROTECTION

- A. Trees and other vegetation designated on the Contract Drawings or directed by the Owner/Engineer to remain shall be protected from damage by all construction operations by erecting suitable barriers, guards and enclosures, or by other approved means. Conduct clearing operations in a manner to prevent falling trees from damaging trees and vegetation designated to remain and to the Work being constructed and so as to provide for the safety of employees and others.
- B. Maintain protection until all Work in the vicinity of the Work being protected has been completed.
- C. Immediately repair any damage to existing tree crowns, trunks, or root systems. Roots exposed and/or damaged during the Work shall immediately be cut off cleanly inside the exposed or damaged area. Treat cut surfaces with an acceptable tree wound paint and topsoil spread over the exposed root area.
- D. When Work is completed, remove all dead and downed trees. Live trees shall be trimmed of all dead and diseased limbs and branches. All cuts shall be cleanly made at their juncture with the trunk or preceding branch without injury to the trunk or remaining branches. Cuts over 1-inch in diameter shall be treated with an acceptable tree wound paint.
- E. Restrict construction activities to those areas within the limits of construction designated on the Contract Drawings, within public rights-of-way, and within easements provided by the Owner. Adjacent properties and improvements thereon, public or private, which become damaged by construction operations, shall be promptly restored to their original condition, to the full satisfaction of the property Owner.
- F. Construct as necessary based on the type of equipment to be used during the pipelines installations, an access road within the right of way to facilitate the construction activity.

END OF SECTION 02100

SECTION 02200 – EARTHWORK

PART 1 – GENERAL

1.1 DESCRIPTION

A. REQUIREMENTS:

Furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, fill and grading required to complete the work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to: excavation for structures, culverts, footings, manholes, pipes, vaults, ducts and paving; backfilling, fill and required borrow; embankment and grading; disposal of surplus and unsuitable materials; and all related work such as sheeting, bracing, dewatering and water handling.

B. CONTENTS AND RELATED WORK:

This section includes the following:

1. Preparation of subgrade for structure foundations, general fill placement, embankment construction, sidewalks and pavement.
2. Placement and compaction of structural fill in soil embankments, and beneath structures, sidewalks and pavements/
3. Excavation and backfill of trenches within construction lines.
4. Excavating and backfilling for underground utilities.
5. Related work:
 - a. Demolition and Salvage: Section 01047
 - b. Site Preparation: Section 02100
 - c. Dewatering and Drainage: Section 02140
 - d. Sedimentation and Erosion Control: Section 02270
 - e. Pavement Removal and Replacement: Section 02500
 - f. Loaming, Seeding and Sodding: Section 02930

C. DEFINITIONS:

1. **COMPACTION:** The construction activities required to obtain a specified percentage of the maximum dry density (MDD) at the measured moisture content determined in accordance with applicable ASTM D1556, ASTM D2937, and ASTM D698. The minimum required percent compaction beneath structures, piping, and pavement is provided in Table A in this section.

2. **EARTH EXCAVATION:** Excavation consists of removal of materials encountered to subgrade elevations indicated, which in the opinion of the Engineer, using guidelines listed below is not classified as rock excavation. All excavation for this project is unclassified.

3. **EARTH EXCAVATION BELOW SUBGRADE:** Same as Earth Excavation except excavation is performed below elevations given as subgrade on the Drawings.

4. **ROCK EXCAVATION:** Excavation of hard mineral mass material, which in the opinion of the Engineer, cannot be removed except by drilling and blasting, and exceeds moderately hard rock hardness, as defined in "Subsurface Manual for Design and Construction of Buildings," 1976, published by the American Society of Civil Engineers. Structure foundations of concrete, masonry, and / or stone shall not be considered rock if not clearly identified as rock on the Drawings and delineated by the Contractor prior to removal. No soft or disintegrated rock which can be removed with a pick, mechanical excavation, and/or previous blasting, will be considered for rock excavation. Rock encountered exterior to the line of excavation measurement as shown in the Drawings will not be allowed as rock excavation. Items such as sidewalks, curbs, streets or roadway pavement shall not be classified as rock excavation.

5. **STRUCTURAL FILL MATERIAL:** Material placed and compacted beneath structures, footings, foundations, slabs and roadways. Structural fill material shall be Type A, B, C or D as determined by the Engineer or as shown on the Drawings.

6. **UNSUITABLE MATERIAL:** Materials which do not meet the requirements of structural fill or common fill and cannot meet the compaction requirements shall be classified as unsuitable material.

7. **ADDITIONAL EXCAVATION:** When excavation has reached the required subgrade elevations and the subgrade bearing materials appear to be unsuitable, notify the Engineer, who will make an inspection of conditions. If the Engineer determines that bearing materials at the required subgrade elevations are unsuitable, a geotechnical consultant may be obtained to determine the depth to continue excavation until suitable bearing materials are encountered, and replace excavated material as directed by the Geotechnical Engineer or the owner with suitable material.

8. **SUBGRADE:** The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials which are shown on the Project Drawings as the planned bottoms for footings, foundations, slabs and/or trench excavations.

9. STRUCTURE: Buildings, foundations, slabs, junction chambers, curbs, or other man-made stationary features occurring above or below ground surface.

1.2 QUALITY ASSURANCE

A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In case of conflict between the requirements of this section and the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM C136	Standard Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D422	Test Method for Particle-Size Analysis of Soils
ASTM D1556	Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods
ASTM D2937	Test Method for Density of Soil in Place by Drive Cylinder Method
ASTM D2216	Test Method for Moisture Content of Soils
ASTM D698	Moisture Density Relationship of Soils Using 5.5lb Rammer and 12in. Drop (Standard Proctor Method of Density Measurement)
ASTM D422	Grain Size Analysis for Soils
ASTM 4318	Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D3017	Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
SCDOT	Standard Specifications for Highway Construction

B. QUALITY ASSURANCE TESTING:

1. An independent quality assurance testing laboratory, under the direction of the Engineer and the Owner, will take soil / aggregate samples and perform moisture content, gradation, compaction, and density tests during placement of backfill materials to check compliance with these specifications. The Contractor shall provide access and remove surface material at locations designated by the Engineer and provide such assistance as necessary for sampling and testing. The Engineer may direct the Contractor to construct inspection trenches in compacted or consolidated backfill to determine that the Contractor has complied with these specifications.

Tests will be made by an independent testing laboratory in accordance with the following test methods:

Test	Standard Procedure
Moisture content	ASTM D3017 or ASTM D2216
Gradation	ASTM C136 or D422
Density in-place	ASTM D1556, 2922 or D2937
Moisture-density relationships	ASTM D698

2. Prior to the general placement of fill, and during such placement, the Engineer may select areas within the limits of the fill for testing the degree of compaction obtained.

3. In-place density testing of trenches shall be a minimum of seventy-five (75) and a maximum of one hundred and twenty-five (125) linear feet of trench and at vertical intervals of 2 feet or less as the fill is being placed, or as determined by the Engineer.

4. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

1.3 SUBMITTALS

Submittals shall be made in accordance with Section 01300. In addition, the following specific information shall be provided:

1. Samples of fill materials proposed for use shall be submitted, per Section 01300, to the Engineer and Owner two (2) weeks in advance of use. Samples shall consist of 0.5 cubic foot or twenty pound (20lb) sample of each type of material, whichever is greater.

2. **FIELD AND LABORATORY TEST REPORTS:** Independent testing laboratory shall furnish the Engineer, Owner and Contractor two (2) copies of the field and laboratory test reports. Passing field test report of in-place density and compaction will be required as evidence of acceptance of materials represented.

3. **AGGREGATE MATERIAL CONFORMANCE TEST RESULTS:** Prior to acceptance of aggregate materials for use as fill material conduct aggregate quality tests in accordance with the requirements of this Section and appropriate reference standards. The Engineer and Owner reserve the right to accept or reject materials based on certification from the supplier that the aggregate meets the requirements of this specification.

4. BORROW SOURCE MATERIAL TEST RESULTS: Prior to acceptance borrow source for soil fill materials conduct quality tests in accordance with the requirements of this Section and appropriate reference standards. The Engineer and Owner reserves the right to accept or reject soil fill materials based on conformance with the materials properties outlined in Section 2.01 of this specification.

1.4 FIELD MEASUREMENTS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

1.5 GENERAL

A. The elevations shown on the Drawings as existing are taken from the best existing data and are intended to give reasonably accurate information about the existing elevations. They are not precise. Become satisfied as to the exact quantities of excavation and fill required.

B. Perform earthwork operations in a safe and proper manner with appropriate precautions being taken against all hazards.

C. Maintain all excavated and filled areas for structures, trenches, fills, topsoil areas, embankments and channels in good condition at all times until final acceptance by the Owner. Repair all damage caused by erosion or other construction operations using material of the same type as the damaged material.

D. Perform earthwork within the rights-of-way of the SCDOT in accordance with requirements and provisions of the permits issued by this agency for the construction within its rights-of-way. Such requirements and provisions, where applicable, will take precedence and supersede the provisions of these Specifications.

E. Control grading in a manner to prevent surface water from running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water can be uninterrupted in existing gutters, other surface drains or temporary drains. Free access must be provided to all parts of project.

F. No classification of excavated materials will be made. Excavation work will include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition or condition thereof.

G. Ensure that all earthwork operations comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations. Conduct operations in a manner acceptable to the Engineer.

H. Make a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which might arise as a result of nearby watercourses and floodplains, particularly in areas where construction activities may encounter water-bearing sands and gravels or limestone solution channels. Provide all services, labor, equipment and

materials necessary or convenient for completing the work within the time specified in these Contract Documents.

1.6 COORDINATION

A. Coordinate work with Engineer, Owner and Contractors as required.

B. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 – MATERIALS

2.1 FILL MATERIALS

A. TYPE A – SELECT FINE-GRAINED FILL MATERIAL:

Type A material shall be a clean gravel / sand mixture free from organic matter and shall conform to the following gradation:

U.S. Standard Sieve Size	Percent by Weight Passing
¾ – inch	100
⅜ – inch	70-100
No. 4	55-100
No. 10	35-95
No. 20	20-80
No. 40	0-55
No. 100	0-2

B. TYPE B – SELECT COARSE GRAINED FILL MATERIAL:

Type B material shall be a select granular material free from organic matter and of such size and gradation that the specified compaction can be readily attained. Material shall have a sand equivalent value determined in accordance with ASTM D2419 of not less than twenty (20) and shall conform to the following gradation:

U.S. Standard Sieve Size	Percent by Weight Passing
3-inch	100
No. 4	35-100
No. 30	20-100

The coefficient of uniformity shall be three (3) or greater.

The material may be an imported quarry screenings, clean natural sand or gravel, select trench excavation or a mixture thereof.

C. TYPE C – GENERAL BACKFILL MATERIAL:

Type C material shall be unclassified material which is free from topsoil, peat, wood, roots, bark, debris, lumber, garbage, rubbish or other extraneous material. The maximum size of rock and / or stone shall not exceed six inches (6"). Type C material will have a plasticity index less than twenty-five percent(25%) and the rock to soil ratio shall not exceed one (1) part rock to three (3) parts soil. If the material excavated from the site meets these requirements, it may be classified as Type C.

D. TYPE D – AGGREGATE BACKFILL:

Type D material shall be free-draining granular material or commonly known as pea gravel and shall conform to the following gradation:

U.S. Standard Sieve Size	Percent by Weight Passing
1/4– inch	100
No. 8	0-5

E. TYPE E – SURGE STONE BACKFILL:

Type E material shall be crushed rock commonly known as drain rock and shall conform to the following gradation:

U.S. Standard Sieve Size	Percent by Weight Passing
1 1/2– inches	100
3/4– inch	30-75
1/2– inches	15-55
1/4– inch	0-5

Type E material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.65.

F. TYPE F – AGGREGATE BASE COARSE (ABC) STONE:

Type F material shall be crushed rock and shall conform to the following gradation:

U.S. Standard Sieve Size	Percent by Weight Passing
1 1/2– inches	87-100
3/4– inch	45-90
No. 4	20-50
No. 30	6-29
No. 200	0-12

Type F material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.65.

G. TYPE G – COARSE AGGREGATE BACKFILL:

Type G material shall be pervious backfill material conforming to the following gradation:

U.S. Standard Sieve Size	Percent by Weight Passing
2 – inch	100
No. 50	0-100
No. 100	0-8
No. 200	0-4

H. TYPE H – CLASS A RIPRAP MATERIAL:

Type H material shall be SCDOT Class A or riprap shall be graded rock having a range of individual rock weights as follows:

Rock Size	Weight of Stone	Percent Smaller by Weight
0.75 feet	37 pounds	100
0.50 feet	11 pounds	50
0.20 feet	0.7 pounds	15

Based on a specific gravity of 2.65.

I. TYPE I – CLASS B RIPRAP MATERIAL:

Type I material shall be SCDOT Class B or riprap shall be graded rock having a range of individual rock weights as follows:

Rock Size	Weight of Stone	Percent Smaller by Weight
1.30 feet	200 pounds	100
0.95 feet	75 pounds	50
0.40 feet	5 pounds	10

Based on a specific gravity of 2.65.

J. TYPE J – UNCLASSIFIED MATERIAL:

Type J material shall be unclassified material and may be obtained from excavation on-site. The material may contain extraneous material such as demolition waste, unsuitable material excavated from beneath structures, and clearing and grubbing debris up to fifty percent (50%) by volume excess fill in non-structural areas. Extraneous material shall be thoroughly mixed and the maximum size of organic particles shall be six inches (6").

PART 3 – EXECUTION

3.1 GENERAL

A. EXCAVATION ACTIVITIES:

Perform excavation and compaction using machinery, except in areas where hand work is necessary to protect structures, buried utilities, and private / public properties. No additional compensation will be paid for hand excavation / compaction unless identified on the Drawings and the Specifications.

Perform excavation and compaction of every description and with all encountered materials to the lines, grades, or depth indicated on the Drawings, and as specified herein.

Extend excavation and compaction a sufficient distance from the footings, and foundations to permit placement and removal of concrete formwork, installation of other utilities and to allow access for inspection and testing.

B. EXCAVATION BELOW SUBGRADE:

Do not excavate below depths indicated on the Drawings or below such depths as required by the Engineer.

Excavation below depths indicated on the Drawings that occur through the fault of the Contractor, shall be restored to the indicated or required depths with suitably compacted structural fill material at the expense of the Contractor. The type of the material used for structural fill for excavation below subgrade will be as selected by the Engineer. The expense for restoration of the materials that were removed with prior approval of the Engineer and Owner will be paid by the Contractor.

If the removal of unsuitable materials below the subgrade is required by Engineer, the voids caused by the approved over excavation shall be backfilled and compacted up to the planned subgrade elevation with Structural Backfill Material.

C. CONTROL OF WATER:

The Contractor shall keep excavations reasonably free from water during construction. The static water level shall be drawn down a minimum of one foot (1') below the bottom of excavations to maintain the undisturbed state of natural soils and allow the placement of any fill to the specified density. Disposal of water shall not damage property or create a public nuisance. The Contractor shall have on hand pumping equipment and machinery in good working condition for emergencies and shall have workmen available for its operation. Dewatering systems shall operate continuously until backfill has been completed to one foot (1') above the normal static groundwater level. Dewatering shall be performed in accordance with Section 02140.

Groundwater shall be controlled to prevent softening of the bottom of excavations, or formation of "quick" conditions. Dewatering systems shall not remove natural soils. The Contractor shall control surface runoff to prevent entry or collection of water in excavations.

Release of groundwater to its static level shall be controlled to prevent disturbance of the natural foundation soils or compacted fill and to prevent flotation or movement of structures or pipelines.

D. SURPLUS MATERIAL:

Unless otherwise specified, surplus excavated material shall be disposed of off-site in accordance with applicable ordinances and environmental requirements.

If the quantity of surplus material is specified, the quantity specified is approximate. The Contractor shall satisfy himself that there is sufficient material available for the completion of the embankments before disposing of any material inside or outside the site. Shortage of material, caused by premature disposal of any material by the Contractor, shall be replaced by the Contractor, at no additional cost to the Owner.

Material shall not be stockpiled to a depth greater than five feet (5') above finished grade within twenty-five feet (25') of any excavation or structure except for those areas designated to be pre-consolidated. For these areas, the depth of stockpiled material shall be as specified. The Contractor shall maintain stability of the soil adjacent to any excavation. The Contractor shall install silt fences around stock piles to prevent release fine and silt particles.

E. HAULING:

When hauling is done over highways or city streets, the loads shall be trimmed and the vehicle shelf areas shall be cleaned after each loading. The loads shall be watered after trimming to eliminate dust.

F. FINISH GRADING:

Finished surfaces shall be smooth, compacted and free from irregularities. The degree of finish shall be that normally obtainable with a blade-grader.

Finished grade shall be as specified by the contours ± 0.10 foot except where a local change in elevation is required to match sidewalks, curbs, manholes and catch basins, or to ensure proper drainage. Allowance for topsoil and grass cover, and sub-base and pavement thickness shall be made so that the specified thickness of topsoil can be applied to attain the finished grade.

When the work is at an intermediate stage of completion, the lines and grades shall be as specified ± 0.5 foot to provide adequate drainage.

If the soil is to be cultivated or straw is to be incorporated into the surface, rocks larger than two and a half (2 ½) inches in maximum dimension, roots and other debris on the surface of the slope shall be removed and disposed of prior to cultivation or placement of straw.

G. ENVIRONMENTAL REQUIREMENTS:

Do not perform excavation, backfilling or compaction when weather conditions are such, in the opinion of the Engineer, that work cannot be performed satisfactorily. Do not use frozen and / or saturated materials containing moisture that will not allow satisfactory compaction.

Prior to start of clearing, grubbing, excavation, stockpiling, or compaction activities, install and verify operation of all erosion control devices shown on the Drawings and as required to meet applicable local laws for Erosion and Sediment Control (E&S).

Maintain storm inlets / sewers, E&S, storm drains, surface drainage, perimeter ditches, and silt fence free of debris and excess sediment build-up. No damming or ponding of water in gutters or other waterways will be permitted.

The Contractor shall maintain earthwork surfaces true and smooth and protected from erosion. Where erosion occurs, the Contractor shall provide fill or shall excavate as necessary to return earthwork surfaces to the grade and finish specified.

Prevent spread of dust during performance of work described in this Section. Moisten excavation areas and clean roadways as necessary to maintain dust control as directed by the Engineer, the Owner, and / or to meet the requirement of State and local environmental laws.

H. STONE STABILIZATION:

When the bottom of the trench is not sufficiently stable to prevent vertical or lateral displacement of the pipe after installation with bedding, stone stabilization will be required to develop a non-yielding foundation for the bedding and pipe. When such conditions are encountered, the trench will be excavated to a depth determined by the Engineer, and #57 crushed stone will be placed to an elevation six inches (6") below the bottom of the pipe. The pipe will then be laid with bedding as directed by the Engineer.

3.2 PROTECTION AND STABILITY OF EXCAVATIONS

The Contractor at its own expense shall protect and provide stability for excavation areas in accordance with Federal, State and local laws, ordinances, and other requirements of agencies having jurisdiction.

At all times maintain compliance with applicable OSHA trench and excavation safety regulations. Slope sides of excavations shall comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated as specified in Section 02350. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

At its own expense the Contractor shall protect adjacent structures, buildings and pipelines in the vicinity of the work. The Contractor will maintain sufficient barricades, planks, chains, flagging and rope to barricade open excavation areas after the completion of work each day.

3.3 PLACEMENT AND COMPACTION OF BEDDING AND FILL MATERIAL FOR PIPELINES AND OTHER APPLICATIONS

Fill material shall be placed in horizontal layers and compacted with power operated tampers, rollers, idlers, or vibratory equipment. Material type, maximum layer depth, relative compaction, and general application are specified in Table A. Unless otherwise specified, fill classes shall be used where specified in Table A under Application.

Table A. Fill Placement and Compaction Requirements

Fill Classes	Material Type	Maximum Uncompressed Layer Depths (in.)	Minimum Relative Compaction, (%)	General Application	
				Pipelines	Other
A1	A	8	95	Bedding and initial backfill	Slabs on grade (other than specified for Class E1)
A2	A	48	95	Initial and subsequent when ponded or jetted	
B1	B	8	95	Subsequent backfill	Structure backfill
B2	B	8	90		Site fill, upper 1 ft. of areas requiring less than ¼ inch of settlement
C1	C	8	90-95	Subsequent backfill compaction as specified	
C2	C	8	90		Site fill, embankments and dikes
D1	D		95	Bedding, initial and subsequent backfill	Bedding for tanks, initial and subsequent tank backfill
E1 ^a	E	8			Fill under slabs for structures and tank slabs with pressure relief valves
F1 ^b	F	12	95	Initial and subsequent backfill	Structural backfill
G1	G	8	95	Bedding for plastic pipe, initial and subsequent backfill	
H1	H				Embankment slope face, channel slope

Table A. Fill Placement and Compaction Requirements

Fill Classes	Material Type	Maximum Uncompressed Layer Depths (in.)	Minimum Relative Compaction, (%)	General Application	
				Pipelines	Other
I1	I				face
J1	J	8	90		Embankment slope face, channel slope face Excess fill in non-structural areas

^a Compaction of layers shall be accomplished in a minimum of 2 passes of equipment with complete coverage across the width of the field.

^b Material shall not be used for bedding or initial backfill for plastic pipe.

3.4 EARTHWORK FOR STRUCTURES

A. STRUCTURAL EXCAVATION:

The bottom shall not be more than 0.15 foot above or below the lines and grades specified. If the elevation of structure excavation is not specified, the excavation shall be not more than 0.1 foot above or below the elevation specified for fill material below the structure. Slopes shall vary no more than 0.5 foot from specified grade unless the excavation is in rock where the maximum variation shall be two feet (2').

Should the excavation be carried below the lines and grades specified on the drawings or should the bottom of the excavation be disturbed because of the Contractor's operations and require over-excavation and backfill, the Contractor shall refill such excavated space to the proper elevation in accordance with the procedure specified for backfill. The cost of such work shall be borne by the Contractor.

Unless otherwise specified, excavations shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where concrete is specified to be placed directly against excavated surfaces.

B. FOUNDATION PREPARATION:

Rock foundations for concrete or manhole bases shall be excavated to sound material. The rock shall be roughly leveled or cut to steps and shall be roughened. Seams in the rock shall be grouted under pressure as directed by the Engineer.

When the manhole bases or pipes are to be supported on piles, excavations shall be completed to the bottom of the footings before any piles are drilled or driven therein. When swell or subsidence results from driving piles, the Contractor shall excavate, or backfill the footing area to the grade of the bottom of the footing with suitable material as specified. If material under footings

is such that it would mix into the concrete during footing placement or would not support the weight of the fluid concrete, the Contractor shall replace the material with suitable material, install soffit forms or otherwise provide a suitable platform on which to cast the footing as directed by the Engineer.

Whenever excavation beneath a structure is substantially completed to grade, the Contractor shall notify the Engineer who will make an inspection of the foundation. No concrete or masonry shall be placed until the foundation has been inspected by the Engineer. The Contractor shall, if directed by the Engineer, dig test pits and make test borings and foundation bearing tests.

C. STRUCTURAL FILL CLASSIFICATION:

Unless otherwise specified, structural fill shall be Class B1, C1, E1 and F1. The structural fill should be placed in nine inch (9") loose lifts at \pm two percent (2%) of the optimum moisture content and compacted to ninety-five percent (95%) of the maximum dry density as determined by ASTM D698. The upper one foot (1') of structural fill placed and compacted beneath structures shall be compacted to ninety-eight percent (98%) of the maximum dry density in accordance with ASTM D698.

After completion of construction below the elevation of the final grade, and prior to backfilling, forms shall be removed and the excavation shall be cleaned of debris.

Structural fill shall not be placed until the pre-fill subgrade has been inspected by the Engineer. No backfill material shall be deposited against concrete structures until the concrete has developed a strength of not less than 2,500 pounds per square inch in compression, or until the concrete has been in place for twenty-eight (28) days, whichever occurs first.

3.5 EARTHWORK FOR PIPELINES AND CONDUITS

A. GENERAL:

Earthwork for other pipelines and conduits is specified in paragraph 02200, 3.03, Table A; in the standard details and in the following paragraphs.

B. PIPELINE EXCAVATION:

The bottom of the trench shall be carried to the specified lines and grades with proper allowance for pipe thickness and for bedding as specified.

C. PIPELINE BACKFILL:

1. **BEDDING:** The Contractor shall not proceed with backfill placement in excavated areas until the subgrade has been inspected by the Engineer. All pipe shall have a minimum thickness of bedding material below the barrel of the pipe as specified. Bedding material shall be placed in the bottom of the trench, leveled and compacted. Bell holes shall be excavated at each pipe joint to permit proper inspection and uniform bearing of pipe on bedding material.

After the pipe has been laid to alignment and grade, unless otherwise specified, additional bedding material shall be placed in layers the full width of the trench and compacted up to the specified level. Bedding shall be placed simultaneously on both sides of the pipe, keeping

the level of backfill the same on each side. The material shall be carefully placed and compacted around the pipe to ensure that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Contractor shall use particular care in placing material on the underside of the pipe to prevent lateral movement during backfilling.

2. INITIAL BACKFILL: After pipe has been properly bedded, Contractor shall place and compact initial backfill as specified in Table A.

3. SUBSEQUENT BACKFILL:

a. General: Backfill material, placement and compaction above the pipe zone shall be as specified. Backfill above the pipe zone shall not commence until pipe zone backfill has been inspected and accepted by the Engineer.

b. Improved Areas: Unless otherwise specified, select granular backfill (Class A1) shall be used under all paved and unpaved roadways and paved and unpaved roadway shoulders, roadway embankments, and in all public right-of-ways and easements. The trench shall be backfilled to an elevation which will permit the placement of the specified surface or paving. Paving shall be as specified in Section 02500. Other surfaces shall be restored, including compaction, to the condition existing prior to construction including restoration of yard areas.

c. Unimproved Areas: Class C1 backfill shall be used for all trenches in pastureland, cultivated land, undeveloped land, and for other unimproved areas where specified. Class C1 backfill shall not be used in any public right-of-way. Trench excavation which meets the requirements of Type C material may be used. The Contractor shall maximize the use of fine-grained materials (e.g., sand, silty sand, sandy silt) as Class C1 backfill.

For Class C1 backfill, the trench above the pipe zone shall be backfilled to within twelve inches (12") of original ground surface. The top twelve inches (12") of soil shall be removed and stored in such a manner that it will not become mixed with unsatisfactory soils. After the trench has been backfilled, the stored topsoil shall be replaced at a uniform depth in its original area compacted to its original condition. The Contractor shall leave the backfilled trench neatly mounded not more than six inches (6") above existing grade for the full width of the Class C1 backfill area.

3.6 EARTHWORK FOR EMBANKMENTS

A. FOUNDATION PREPARATION:

The surface of the embankment foundation shall not contain standing water and shall be free of loose material, foreign objects and rocks greater than six inches (6") in maximum dimension. Immediately prior to placement of embankment fill material, the embankment foundation shall be proof-rolled with a loaded dump truck or (twenty) 20-ton rubber-tired roller. The proof-roll will identify suitable soft subgrade soils and areas with adequate embankment foundation soils. Near surface embankment foundation soils that have suitable in-place moisture content should be scarified to a depth of six inches (6"), moisture conditioned as necessary and compacted to ninety-five percent (95%) of the maximum dry density in accordance with ASTM D698. Areas identified during the proof-roll as having soft, yielding, or unsuitable soils shall be removed, and replaced with suitability compacted structural fill material. After the embankment foundation preparation has been completed, the Contractor shall promptly place and compact the first lift of

embankment fill to prevent damage to the surface. The surface of the embankment shall be maintained to permit travel of construction equipment. Ruts in the surface of any layer shall be filled and leveled before compacting subsequent lifts.

B. EMBANKMENT FILL:

Rocks, broken concrete or other solid materials, which are larger than four inches (4") in greatest dimension, shall not be placed in embankment areas where piles are to be placed or driven.

Fill material having a sand equivalent value less than ten (10) shall be placed in the lower portions of embankments and shall not be placed within two and one half feet (2.5') of finished grade.

When the embankment material consists of large, rocky material or hard lumps, such as hardpan or cemented gravel which cannot be broken readily, such material shall be well distributed throughout the embankment. Sufficient earth or other fine material shall be placed around the larger material as it is deposited so as to fill the interstices and produce a dense, compact embankment.

Embankment fill should be placed in 10-inch loose lifts at \pm three percent (3%) of the optimum moisture content and compacted to ninety-five percent (95%) of the maximum dry density as determined by ASTM D698.

C. EMBANKMENT TOLERANCES:

1. **GENERAL:** Embankment slopes within four feet (4') of shoulder grade shall vary less than one half foot (0.5") from the designated slope. Slopes beyond four feet (4') from shoulder grade shall vary less than one foot (1') from the designated slope. Measurements for variance shall be made perpendicular to the slope. Slopes which are six to one (6:1) or flatter shall vary less than 0.2 foot from the designated slope.

If embankments are constructed of rock greater than twelve inches (12") in diameter, the slopes more than four feet (4') below shoulder grade may vary up to two feet (2') from the designated slope.

2. **ROADWAY EMBANKMENT TOLERANCES:** The excavated surface shall be less than 0.08 foot above or below the grades specified after deducting for the roadway pavement thickness.

Vertical alignment tolerances permitted on the roadway surface shall not exceed ± 0.30 foot from the vertical alignment specified, with the provision that within the tolerance range local surface irregularities shall not exceed 0.15 foot as measured by the gap between the roadway surface and a ten foot (10') straightedge placed on any flat graded surface. On vertical curves, the same standards will apply except that an additional gap allowance will be made for the road surface curvature over the ten foot (10') length of the straightedge.

Horizontal alignment tolerances permitted shall not exceed \pm one foot (1'), providing the departure is relatively uniform over any specific length of the roadway.

Roadway median strips shall be graded to drain and shall not vary more than 0.1 foot from the specified grade.

3.7 SUBGRADE FOR PAVEMENT

The soil subgrade beneath the aggregate base course of pavements shall be scarified to a depth of nine inches (9") and re-compacted to at least ninety-eight percent (98%) of the maximum density as determined by ASTM D698.

3.8 NON-STRUCTURAL SITE FILL

Unless otherwise specified, site fill shall be Class C2 fill. If the existing slope in an area to be filled is greater than 5(H):1(V), the Contractor shall bench the area prior to filling.

END OF SECTION 02200

SECTION 02220 - EXCAVATION AND BACKFILL

PART 1 - GENERAL

- 1.1 DESCRIPTION OF WORK: The extent of excavation and backfill is limited to the areas of construction, and includes (but is not necessarily limited to) stockpiling of topsoil, site grading, excavation of footings and trenches, filling, backfilling, compaction, finish grading, and spreading of topsoil. Perform all excavation, dewatering, sheeting, bracing, and backfilling in such a manner as to eliminate all possibility of undermining or disturbing the foundations of existing structures.
- 1.2 QUALITY ASSURANCE:
- A. Referenced Standards: Unless otherwise indicated, all referenced standards shall be the latest edition available at the time of bidding. Any requirements of these Specifications shall in no way invalidate the minimum requirements of the referenced standards. Comply with the provisions of the following codes and standards, except as otherwise shown in report of geotechnical exploration.
1. ASTM D 698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. (2.49Kg) Rammer and 12 inch (305 mm) Drop.
 2. ASTM D 3282 Recommended Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.
- 1.3 SOIL TESTING AND INSPECTION SERVICE: All compaction tests of all fill areas will be made by an independent testing laboratory as indicated in Section 01100.
- A. Rework any fill areas which fail to meet the compaction requirements as herein specified and perform this work at no additional cost to the Owner. Testing of fill areas will be provided by the Architect, except that tests which reveal nonconformance with the Specifications and all succeeding tests for the same area, until conformance with the Specifications is established, shall be at the expense of the Contractor.
- 1.4 JOB CONDITIONS:
- A. Existing Utilities: Locate existing underground utilities in the areas of work. Verify all utility locations with authorities providing utilities and a utility location service. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Engineer immediately for directions as to procedure. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of utility companies.

- C. Do not interrupt existing utilities serving facilities occupied and used by others, except when permitted in writing by the Owner, and then only after acceptable temporary utility services have been provided.
- D. Demolish, and completely remove from site, existing underground utilities that conflict with construction and are no longer active. Coordinate with utility companies for shut-off of services if lines are active.
- E. Temporary Protection: Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- F. Sheeting And Bracing: Make all excavations in accordance with the rules and regulations promulgated by the Department of Labor, Occupational Safety and Health Administration, "Safety and Health Regulations for Construction." Furnish, put in place, and maintain such sheeting, bracing, etc., as may be necessary to support the sides of the excavation and to prevent any movement of earth which could in any way diminish the width of the excavation to less than that necessary for proper construction, or could otherwise injure or delay the work, or endanger adjacent structures, roads, utilities, or other improvements.

PART 2 - PRODUCTS

2.1 DEFINITIONS:

- A. Satisfactory Subgrade Soil Materials: Soils complying with ASTM D 3282, soil classification Groups A-1, A-2-4, A-2-5, and A-3.
- B. Unsatisfactory Subgrade Soil Materials: Soils described in ASTM D 3282, soil classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7; also peat and other highly organic soils, unless otherwise acceptable to the Engineer.
- C. Cohesionless Soil Materials: Gravels, sand-gravel mixtures, sands, and gravelly-sands.
- D. Cohesive Soil Materials: Clayey and silty gravels, sand-clay mixtures, gravel-silt mixtures, clayey and silty sands, sand-silt mixtures, clays, silts, and very fine sands.

2.2 SOIL MATERIALS:

- A. Backfill And Fill Materials: Provide satisfactory soil materials for backfill and fill, free of masonry, rock, or gravel larger than 2 inches in any dimension, and free of metal, gypsum, lime, debris, waste, frozen materials, vegetable, and other deleterious matter. Use only excavated material that has been sampled, tested, and certified as satisfactory soil material.

PART 3 - EXECUTION

- 3.1 **INSPECTION:** Examine the areas and conditions under which excavating and backfilling is to be performed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.
- 3.2 **EXCAVATION:** Excavation consists of the removal and disposal of all materials encountered for pipework, and other construction as shown on the Drawings. Perform all excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- 3.3 **STRIPPING:** Remove all topsoil, vegetable matter, and organic materials over proposed excavations. Stockpile the stripped materials which are suitable for reuse and preserve for resspreading on completed surfaces. Protect and maintain topsoil stockpile until needed.
- 3.4 **EXCAVATION CLASSIFICATION:** All excavation will be performed as unclassified excavation and includes excavation to required subgrade elevations regardless of the character of material encountered with the exception of "Rock" as defined herein.
 - A. Rock excavation includes removal and disposal of rock material and obstructions encountered that cannot be removed by a single toothed ripper drawn by a crawler tractor having a minimum draw bar pull rated at 36,000 lbs. (D-8 or equivalent) occupying an original volume of at least one cubic yard or for trench excavations, rock materials or obstructions which cannot be excavated with a backhoe having a break-out force of not less than 26,000 lbs. (JD 93 series or equivalent) and occupying an original volume of at least one half cubic yard without systematic drilling, blasting, or ripping.
 - B. Intermittent drilling, blasting, or ripping to increase production and not necessary to permit excavation of material encountered will be considered unclassified excavation.
- 3.7 **SITE GRADING:** Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finish the surface within specified tolerances; compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- 3.8 **GROUND SURFACE PREPARATION:** Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface. Shape the subgrade as indicated on the Drawings by forking, furrowing, or plowing so that the first layer of new material placed thereon will be well bonded to it.
- 3.9 **PLACEMENT AND COMPACTION:** Place backfill and fill materials in layers not more than 6 inches in loose depth. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to the

- required percentage of maximum density for each area classification. Do not place backfill or material on surfaces that are muddy, frozen, or contain frost or ice.
- 3.11 In areas not accessible to rollers or compactors, compact the fill with mechanical hand tampers. If the mixture is excessively moistened by rain, aerate the material by means of blade graders, harrows, or other approved equipment, until the moisture content of the mixture is satisfactory. Finish the surface of the layer by blading or rolling with a smooth roller, or a combination thereof, and leave the surface smooth and free from waves and inequalities.
 - 3.12 Place backfill and fill materials evenly adjacent to structures, to the required elevations. Take care to prevent wedging action of backfill against structures. Carry the material uniformly around all parts of the structure to approximately the same elevation in each lift.
 - 3.13 When existing ground surface has a density less than that specified under the subsection entitled COMPACTION for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.
 - 3.14 GRADING OUTSIDE BUILDING LINES: Grade to drain away from structures to prevent ponding of water. Finish surfaces free from irregular surface changes.
 - 3.15 PLANTING AREAS: Finish areas to receive topsoil to within not more than one inch above or below the required subgrade elevations, compacted as specified, and free from irregular surface changes.
 - 3.16 WALKS: Shape the surface of areas under walks to line, grade, and cross-section, with the finish surface not more than zero inches above or one inch below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains.
 - 3.17 PAVEMENTS: Shape the surface of the areas under pavement to line, grade and cross section, with finish surface not more than 1/2-inch above or below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains. Include such operations as plowing, discing, and any moisture or aerating required to provide the optimum moisture content for compaction.
 - 3.18 Fill low areas resulting from removal of unsatisfactory soil materials, obstructions, and other deleterious materials, using satisfactory soil material. Shape to line, grade, and cross section as shown on the Drawings.
 - 3.19 Protection Of Graded Areas: Protect newly graded areas from traffic and erosion, and keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
 - 3.20 RECONDITIONING COMPACTED AREAS: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather prior to

acceptance of work, scarify surface, reshape, and compact to required density prior to further construction.

- 3.21 **UNAUTHORIZED EXCAVATION:** Unauthorized excavation consists of the removal of materials beyond indicated elevations without the specific direction of the Engineer. Under footings, foundations, bases, etc., fill unauthorized excavation by extending the indicated bottom elevation of the concrete to the bottom of the excavation, without altering the required top elevation. Lean concrete fill may be used to bring elevations to proper position only when acceptable to the Engineer. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by the Engineer.
- 3.22 **DEWATERING:** Prevent surface water and subsurface or ground water from flowing into excavated areas by using berms or drainage ditches. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations. Dispose of all water pumped or drained from the work in a suitable manner without undue interference with other work, damage to pavements, other surfaces or property. Provide suitable temporary pipes, flumes or channels for water which may flow along or across the site of the work.
- 3.23 **MATERIAL STORAGE:** Stockpile satisfactory excavated materials where directed by architect, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
- A. Locate and retain soil materials away from edge of excavations.
- 3.25 **EXCAVATION FOR STRUCTURES:** Conform to elevations and dimensions shown within a tolerance of plus or minus one inch, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction required, and for inspection.
- 3.26 **BACKFILL AROUND STRUCTURES:** Unless otherwise specified or indicated on the Drawings, use suitable material for backfill which was removed in the course of making the construction excavations. Do not use frozen material for the backfill and do not place backfill upon frozen material. Remove previously frozen material before new backfill is placed.
- A. **Material:** Approved selected materials available from the excavations may be used for backfilling around structures. Obtain material needed in addition to that of construction excavations from approved banks or other approved deposits. Furnish all borrow material needed on the work. Place and compact all material, whether from the excavation or borrow, to make a dense, stable fill. Use fill material which contains no vegetation, masses of roots, individual roots over 18 inches long or more than 1/2-inch in diameter, stones over 2 inches in diameter, or porous matter. Organic matter must not exceed minor quantities.

- B. Placing Backfill: Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage. Make special leakage tests, if required, as soon as practicable after the structures are structurally adequate and other necessary work has been done. Use the best of the excavated materials in backfilling within 2 feet of the structure. Avoid unequal soil pressures by depositing the material evenly around the structure.
 - C. Place fill and backfill in layers not more than 6 inches thick, except as specified otherwise herein, and compact each layer evenly to the specified density. Do not backfill against concrete without Engineer's approval.
- 3.27 TRENCH EXCAVATION: Perform all excavation of every description and of whatever substance encountered so that pipe can be laid to the alignment and depth shown on the Drawings.
- A. Brace and shore all trenches, where required, in accordance with the rules and regulations, promulgated by the Department of Labor, Occupational Safety and Health Administration, "Safety and Health Regulations for Construction".
 - B. Make all excavations by open cut unless otherwise specified or indicated on the Drawings.
 - C. Width Of Trenches: Excavate trenches sufficiently wide to allow proper installation of pipe, fittings and other materials and not more than 12 inches clear of pipe on either side at any point. Do not widen trenches by scraping or loosening materials from the sides. Where supports, and sheeting and bracing are required, trench may be of extra width so as to permit the placing of the trench supporting material.
 - D. Trench Excavation In Earth: Earth excavation includes all excavation of whatever substance encountered. In locations where pipe is to be bedded in earth excavated trenches, fine grade the bottoms of such trenches to allow firm bearing for the bottom of the pipe on undisturbed earth. Where any part of the trench has been excavated below the grade of the pipe, fill the part excavated below such grade with pipe bedding material and compact at the Contractor's expense.
 - F. Trench Excavation In Fill: If pipe is to be laid in embankments or other recently filled material, first place the fill material to the finish grade or to a height of at least one foot above the top of the pipe, whichever is the lesser. Take particular care to ensure maximum consolidation of material under the pipe location. Excavate the pipe trench as though in undisturbed material.
 - G. Trench Bottom In Poor Soil: Excavate and remove unstable or unsuitable soil to a width and depth, as directed by the Engineer, and refill with a thoroughly compacted gravel bedding.

- H Bell Holes: Provide bell holes at each joint to permit the joint to be made properly and to provide a continuous bearing and support for the pipe.
- I Trench Backfill: Unless otherwise specified or indicated on the Drawings, use suitable material for backfill which was removed in the course of making the construction excavations. Do not use frozen material for the backfill and do not place backfill on frozen material. Remove previously frozen material before new backfill is placed. Start backfilling as soon as practicable after the pipes have been laid and inspected by the engineer, or the structures have been built and are structurally adequate to support the loads, including construction loads to which they will be subjected, and proceed until its completion.
- J Should the Contractor wish to minimize the maintenance of lights, and barricades, and the obstruction of traffic, he may, at his own risk, backfill the entire trench as soon as practicable after installation of pipe, and the related structures have acquired a suitable degree of strength. He shall, however, be responsible for removing and later replacing such backfill, at his own expense, should he be ordered to do so in order to locate and repair or replace leaking or defective joints or pipe.
- K Materials: The nature of the materials will govern both their acceptability for backfill and the methods best suited for their placement and compaction in the backfill. Both are subject to the approval of the Engineer. Do not place stone or rock fragments larger than 2 inches in greatest dimension in the backfill. Do not drop large masses of backfill material into the trench in such a manner as to endanger the pipe line. Use a timber grillage to break the fall of material dropped from a height of more than 5 feet. Exclude pieces of bituminous pavement from the backfill unless their use is expressly permitted.
- L Zone Around Pipe: Place bedding material to the level shown on the Drawings and work material carefully around the pipe to ensure that all voids are filled, particularly in bell holes. For backfill up to a level of 2 feet over the top of the pipe, use only selected materials containing no rock, clods or organic materials. Place the backfill and compact thoroughly under the pipe haunches and up to the mid-line of the pipe in layers not exceeding 6 inches in depth. Place each layer and tamp carefully and uniformly so as to eliminate the possibility of lateral displacement. Place and compact the remainder of the zone around the pipe and to a height of one foot above the pipe in layers not exceeding 6 inches and compact to a maximum density of at least 100 percent as determined by ASTM D 698.
- M Tamping: Deposit and spread backfill materials in uniform, parallel layers not exceeding 12 inches thick before compaction. Tamp each layer before the next layer is placed to obtain a thoroughly compacted mass. Furnish and use, if necessary, an adequate number of power driven tampers, each weighing at least 20 pounds for this purpose. Take care that the material close to the bank, as well as in all other portions of the trench, is thoroughly compacted. When the trench width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe,

backfill may, on approval, be compacted by the use of suitable rollers, tractors, or similar powered equipment instead of by tamping. For compaction by tamping (or rolling), the rate at which backfilling material is deposited in the trench shall not exceed that permitted by the facilities for its spreading, leveling and compacting as furnished by the Contractor.

- N. Wet the material by sprinkling, if necessary, to ensure proper compaction by tamping (or rolling). Perform no compaction by tamping (or rolling) when the material is too wet either from rain or applied water to be compacted properly.
- O. Trench Compaction: Compact backfill in pipe trenches to the maximum density as shown on the Drawings, or as listed in the subsection entitled COMPACTION, with a moisture content within the range of values of maximum density as indicated by the moisture-density relationship curve.
- P. Compaction: Control soil compaction during construction providing at least the minimum percentage of density specified for each area classification.
- Q. Percentage Of Maximum Density Requirements: After compaction, all fill will be tested in accordance with Method "C" of ASTM D 698, unless specified otherwise. Except as noted otherwise for the zone around pipe, provide not less than the following percentages of maximum density of soil material compacted at optimum moisture content, for the actual density of each layer of soil material-in-place:
 - 1. Trench Backfill (Paved Areas): Top 18" - 100%; Remainder-95%.
 - 2. Trench Backfill (Unpaved Areas): Compact Full Depth To 92%.
 - 3. All Other Backfill: Top 24"- 100%; Remainder - 95%.
- R. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing, until moisture content is reduced to a satisfactory value, as determined by moisture-density relation tests.
- S. Disposal Of Surplus Material: Upon approval of the Engineer, haul all surplus materials not needed or acceptable for backfill and legally dispose of it.

3.49 EXCAVATION NEAR EXISTING UTILITIES AND STRUCTURES:

- A. Existing Utilities: Attention is directed to the fact that there are pipes, drains, and other utilities in locations adjacent to the proposed work. Where information is available as to the location of existing pipes, drains, and other utilities, the approximate locations have been indicated on the Drawings; however, the completeness or accuracy of the information given is not guaranteed.

- B. As the excavation approaches pipes, conduits, or other underground structures, discontinue digging by machinery and excavate by means of hand tools, as directed. Such manual excavation, when incidental to normal excavation, is included in the work to be done under items involving normal excavation.
- C. Where determination of the exact location of a pipe or other underground structure is necessary for doing the work properly, the Contractor may be required to excavate test pits to determine such locations. When such test pits may be properly considered as incidental to other excavation, the work is understood to be included as a part of the excavation.
- D. Existing Structures: Support and protect from damage all existing pipes, poles, wires, fences, guard rails, curbing, catch basins, manholes, property line markers, and other structures which do not require temporary or permanent relocation.
- E. Restore or replace damaged items, without compensation, to the condition in which they were found immediately before the work under this project was begun.
- F. Fences: Remove fences which interfere with the Contractor's operation and (unless otherwise specified) later restore them to a condition at least as good as that in which they were found immediately before the work was begun, all without additional compensation. Restore fences as promptly as possible and do not leave until the end of the construction period.
- G. Property Markers: Replace property line markers which are disturbed or removed. Have this work performed by a Registered Land Surveyor.
- H. Care And Restoration Of Property: Enclose the trunks of trees which are to remain adjacent to the work with substantial wooden boxes of such height as may be necessary to protect them from piled material, equipment or equipment operation. Use excavating machinery and cranes of suitable type and operate the equipment with care to prevent injury to remaining tree trunks, roots, branches and limbs.
- I. Do not cut branches, limbs, and roots except by permission of the Engineer. Cut smoothly and neatly without splitting or crushing. In case of cutting or unavoidable injury to branches, limbs, and trunks of trees, neatly trim the cut or injured portions and cover with an application of grafting wax or tree healing paint as directed.
- J. Protect by suitable means all cultivated hedges, shrubs and plants which might be injured by the Contractor's operations. Promptly heel in any such trees or shrubbery necessary to be removed and replanted. Perform heeling in and replanting under the direction of a licensed and experienced nurseryman. Replant in their original position all removed shrubbery and trees after construction operations have been substantially completed and care for until growth is reestablished.
- K. Replace cultivated hedges, shrubs, and plants injured to such a degree as to affect their growth or diminish their beauty or usefulness, by items of kind and quality at least equal to the kind and quality existing at the start of the work.

- L. Do not operate tractors, bulldozers or other power-operated equipment on paved surfaces if the treads or wheels of the equipment are so shaped as to cut or otherwise injure the surfaces.
- M. Restore all surfaces, including lawns, grassed, and planted areas which have been injured by the Contractor's operations, to a condition at least equal to that in which they were found immediately before the work was begun. Use suitable materials and methods for such restoration. Maintain all restored plantings by cutting, trimming, fertilizing, etc., until acceptance. Restore existing property or structures as promptly as practicable and do not leave until the end of construction period. Refer to Section 013233 for PHOTOGRAPHIC DOCUMENTATION required prior to start of work.
- N. Protection Of Streams: Exercise reasonable precaution to prevent the silting of streams. Provide at Contractor's expense temporary erosion and sediment control measures to prevent the silting of streams and existing drainage facilities.

3.27 EROSION CONTROL:

- A. General: Exercise precaution to prevent the erosion of disturbed surfaces. Provide temporary erosion and sediment control measures to prevent the silting of existing drainage facilities.
- B. Air Pollution: Comply with all pollution control rules, regulations, ordinances, and statutes which apply to any work performed under the Contract, including any air pollution control rules, regulations, ordinances and statutes, or any municipal regulations pertaining to air pollution.
- C. During the progress of the work, maintain the area of activity, including sweeping and sprinkling of streets as necessary, so as to minimize the creation and dispersion of dust. If the Engineer decides that it is necessary to use calcium chloride or more effective dust control, furnish and spread the material, as directed, and without additional compensation.

3.28 BRIDGING TRENCHES: Provide suitable and safe bridges and other crossings where required for the accommodation of travel; provide access to private property during construction, and remove said structures thereafter.

- A. Bridge or backfill trenches in any portion of the travel lanes of public or private roads, or drives, at the end of each day's operation to provide for safe travel. No additional compensation will be made for this work.

3.29 RESPREADING TOPSOIL: This work consists of preparing the ground surface for topsoil application and removing topsoil from stockpile and placing and spreading the topsoil on smooth, graded areas in accordance with these Specifications.

- A. Supply topsoil reasonably free from subsoil, clay lumps, stones, or other similar objects larger than 2 inches in greatest diameter, brush, stumps, roots,

objectionable weeds or litter, excess acid or alkali, or any other material or substance which may be harmful to plant growth or a hindrance to subsequent smooth grading, planting, and maintenance operations.

- B. Inventory topsoil requirements with the owner's landscape staff. Evaluate amount of topsoil needed and locations needed. Respread topsoil on all excavated areas and areas damaged by the work after coordinating with the owner. Clear the surface of the areas to be topsoiled of all stones larger than 4 inches in greatest dimension and all litter or other material which may be detrimental to proper bonding, the rise of capillary moisture, and the proper growth of the desired planting. Maintain the grades on the areas to be top-soiled in a true and even condition. Where grades have not been established, smooth grade the area and leave the surface at the prescribed grades in an even and properly compacted condition, which insofar as practical will prevent the formation of low places or pockets where water will stand.
- C. Dump the topsoil in separate piles uniformly distributed in planting and seed areas so that when spread it will give a 4-inch depth of topsoil over the graded area. Leave in place the piles of topsoil on any given area until it has been determined that the requirements of the Specifications have been met and spreading has been authorized by the Engineer. Evenly spread the topsoil over the areas by a blade grader or other equipment. Spread in such a manner that grassing operations can proceed with a minimum of soil preparation or tilling. Correct any irregularities in the surface, resulting from topsoiling or other operations, insofar as practical to prevent the formation of low places and pockets where water will stand. Do not place topsoil when it or the ground surface is frozen, excessively wet, or in a condition otherwise unsatisfactory for preparation of planting surfaces or smooth grading operations.
- D. After the topsoil has been spread and the area smoothed to the specified grades, clear the surface of all stones, roots, other objects larger than 2 inches in greatest diameter, and of all wire, brush or other objects that may interfere with subsequent planting or maintenance operations. Remove promptly any topsoil or other dirt which may be brought upon concrete or pavement as a result of hauling of topsoil.

END OF SECTION 02220

SECTION 02510 – STONE BASE COURSE

PART 1 – GENERAL

- 1.1 This Section includes provisions for stone base course over prepared sub-base and primed with bituminous material. The stone base course shall comply with the latest Edition of the SCDOT Standard Specifications for Highway Construction.
- 1.2 SUBMITTALS: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

PART 2 – PRODUCTS

- 2.1 Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.
- 2.2 GRADE CONTROL: Establish and maintain required lines and elevations.
- 2.3 MATERIALS: Use locally available materials and gradations that exhibit a satisfactory record of previous installations.
- A. Coarse Aggregate: Coarse aggregate (material retained on No. 4 sieve) shall consist of hard, durable particles of stone and shall be reasonably free from thin and elongated pieces, disintegrated particles, vegetable or other deleterious substances. Gravel shall contain at least 50 percent, by weight, of particles having at least one fractured face. When subjected to the Los Angeles Abrasion Test (AASHTO T-96), the coarse aggregate shall have an abrasion loss of not more than 65 percent.
- B. Fine Aggregate: Fine aggregate (passing No. 4 sieve) shall consist of material produced by crushing operations. The liquid index shall not exceed 25 and the plastic index shall not exceed 6 when tested in accordance with AASHTO T-89 and T-90, respectively.
- C. Composite Mixture: Composite mixture shall be free from vegetable matter, lumps or balls of clay, and other deleterious substances. The composite mixture can be produced in one crushing operation or by blending the coarse and fine aggregates in proper proportions. The composite mixture shall meet the following requirements:

<u>Sieve Designation</u>	<u>Percent by Weight Passing</u>
2"	100
1-1/2"	95-100
1"	70-100
1/2"	48-75
No. 4	30-50
No. 30	11-30
No. 200	0-12
Liquid Limit	25 Maximum
Plasticity Index	6 Maximum

PART 3 – EXECUTION

- 3.1 SURFACE PREPARATION: Remove loose material from compacted sub-base surface immediately before applying herbicide treatment or prime coat.
- A. Proof-roll prepared sub-base surface to check for unstable areas and areas requiring additional compaction.
 - B. Notify Architect of unsatisfactory conditions. Do not install stone base course until deficient sub-base areas have been corrected.
- 3.2 PLACEMENT OF BASE COURSE: Material shall be placed on the prepared sub-base in such a manner that the finished base will conform to the lines, grades and required thickness. Where the required thickness is 8" or less, the base may be constructed in one layer. Where the required compacted thickness is more than 8", the base course shall be constructed in two or more layers of approximately equal thickness, the maximum compacted thickness of any one layer not to exceed 8". Each layer shall be compacted as specified herein before the succeeding layer is placed.
- 3.3 COMPACTION OF BASE COURSE: The compaction of the base course shall be achieved using the proper equipment. Compaction of the base course shall be continued until a density of 98 percent of standard proctor density is achieved. Should the sub-grade become unstable after the base course has been placed, the affected section shall be repaired by removing the base course material, the unsatisfactory sub-grade material and replacing the sub-grade material with suitable material and re-compacting and reshaping the sub-grade to the required cross-section, grade and required compaction.
- 3.4 TOLERANCE IN THICKNESS OF BASE: The thickness of the completed base course shall be measured at intervals not exceeding one per 5000 square feet. Where the base course is deficient by 1/2" or more, the Contractor shall correct such areas by scarifying, adding base material and re-compacting to the required density.
- 3.5 APPLICATION OF PRIME COAT: Bituminous prime material shall not be applied until all irregularities in the base course have been repaired and seasoned nor shall prime be applied until the density of the base has been approved by the Engineer. The base shall be cleaned of all mud, dirt, dust and caked or loose material of any description by brooming, blowing or other methods so as to expose the coarse aggregate in the base course. The base shall be dry before prime is applied.
- 3.6 The rate of application of the prime shall be from 0.25 to 0.30 gallons per square yard.
- 3.7 MAINTENANCE: The Contractor is required to machine the base course as often as is necessary to maintain it smooth and true to grade, and to prevent raveling by application of water as may be required to keep the base tightly bound until prime is applied. Defects which develop shall be repaired.

END OF SECTION 02510

SECTION 02520 - PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

- 1.1 This Section includes exterior portland cement concrete paving for the following:
- A. Walkways.
 - B. Curbs and gutters.
- 1.2 SUBMITTALS: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- A. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect/Engineer.
 - B. Design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 - C. Laboratory test reports for evaluation of concrete materials and mix design tests.
- 1.2 QUALITY ASSURANCE:
- A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.
 - 1 American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
 - 2 ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 3 Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
 - B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.
 - C. Concrete Testing Service: Utilize the Owner's testing agency to perform materials evaluation tests and to design concrete mixes.

PART 2 - PRODUCTS

- 2.1 FORMS:
- A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - B. Use flexible or curved forms for curves of a 100-foot or less radius.

- C. Form Release Agent: Provide commercial formulation form- release agent with a maximum of 350 mg/l volatile organic compounds (VOC's) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 REINFORCING MATERIALS:

- A. Reinforcing Bars and Tie Bars: ASTM A615, Grade 60, deformed.
- B. Welded Steel Wire Fabric: ASTM A185, furnished in flat sheets, not rolls, unless otherwise acceptable to Architect/Engineer.
- C. Joint Dowel Bars: Plain steel bars, ASTM A615, Grade 60. Cut bars true to length with ends square and free of burrs.
- D. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications.
- E. Use supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS:

- A. Portland Cement: ASTM C150, Type I, use one brand of cement throughout Project unless otherwise acceptable to Architect/Engineer.
- B. Fly Ash: ASTM C618, Type F.
- C. Normal-Weight Aggregates: ASTM C33, Class 4, and as follows. Provide aggregates from a single source.
- D. Maximum Aggregate Size: 1-1/2 inches, do not use fine or coarse aggregates that contain substances that cause spalling.
- E. Local aggregates not complying with ASTM C33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect/Engineer.

2.4 WATER: Potable.

2.5 ADMIXTURES: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

- A. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
- B. Water-Reducing Admixture: ASTM C494, Type A.
- C. High-Range Water-Reducing Admixture: ASTM C494, Type F or Type G.

- D. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.
- E. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
- F. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1 Air-Entraining Admixture:
Darex AEA or Daravair; W.R. Grace & Co.
MB-VR or Micro-Air; Master Builders, Inc.
Sika AER; Sika Corp.
 - 2 Water-Reducing Admixture:
WRDA; W.R. Grace & Co.
Pozzolith Normal or Polyheed; Master Builders, Inc.
Plastocrete 161; Sika Corp.
 - 3 High-Range Water-Reducing Admixture:
WRDA 19 or Daracem; W.R. Grace & Co.
Rheobuild or Polyheed; Master Builders, Inc.
Sikament 300; Sika Corp.
 - 4 Water-Reducing and Accelerating Admixture:
Daraset; W.R. Grace & Co.
Pozzutec 20; Master Builders, Inc.
 - 5 Water-Reducing and Retarding Admixture:
Daratard-17; W.R. Grace & Co.
Pozzolith R; Master Builders, Inc.
Plastiment; Sika Corporation.

2.6 CURING MATERIALS:

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- B. Moisture-Retaining Cover: One of the following, complying with ASTM C171.
 - 1 Waterproof paper.
 - 2 Polyethylene film.
 - 3 White burlap-polyethylene sheet.
- C. Clear Solvent-Borne Liquid Membrane-Forming Curing Compound: ASTM C309, Type I, Class A or B, wax free.
- D. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
- E. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
- F. Clear Solvent-Borne Liquid Membrane-Forming Curing Compound:

- 1 Masterkure; Master Builders, Inc.
- 2 Kure-N-Seal; Sonneborn-Chemrex.
- 3 Horn Clear Seal; Tamms/A.C. Horn.

G. Clear Waterborne Membrane-Forming Curing Compound:

- 1 Masterkure 100W; Master Builders, Inc.
- 2 Kure-N-Seal WB; Sonneborn-Chemrex.
- 3 Horncure 100; Tamms/A.C. Horn.

H. Evaporation Control: Confilm; Master Builders, Inc., or approved equal

2.7 RELATED MATERIALS:

- A. Bonding Agent: Acrylic or styrene butadiene.
- B. Epoxy Adhesive: ASTM C881, two-component material suitable for dry or damp surfaces. Provide material type, grade, and class to suit requirements.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Bonding Agent: Daraweld C; W.R. Grace & Co.
Acryl-Set; Master Builders Inc.
Sonocrete; Sonneborn-Chemrex.
2. Epoxy Adhesive: Concreative Standard Liquid; Master Builders, Inc.
Sikadur 32 Hi-Mod; Sika Corp.
Epoxitite Binder 2390; Tamms/A.C. Horn, Inc.

PART 3 - EXECUTION

3.1 CONCRETE MIX:

- A. Prepare design mixes for each type and strength of normal- weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use the Architect's testing agency for preparing and reporting proposed mix designs.
- B. Do not use the Owner's field quality-control testing agency as the independent testing agency.
- C. Limit use of fly ash to 25 percent of cement content by weight.
- D. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:

1. Compressive Strength (28-Day): 4000 psi: Driveways, Parking Aprons & Equipment Pads
 2. Compressive Strength (28-Day): 3000 psi: Curb & Curb, walkways
- E. Maximum Water-Cement Ratio at Point of Placement: 0.45.
- F. Slump Limit at Point of Placement: 3 inches.
- G. Slump limit for concrete containing high-range water-reducing admixture (super plasticizer): Not more than 8 inches after adding admixture to site-verified 2 -to-3- inch slump concrete.
- H. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows with a tolerance of plus or minus 1- 1/2 percent:
- I. Air Content: 5.5 percent for 1-1/2-inch maximum aggregate.

3.2 CONCRETE MIXING:

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C94.
- B. When air temperature is between 85 deg F (30 deg.C) and 90 deg F (32 deg.C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg.C), reduce mixing and delivery time to 60 minutes.
- C. Surface Preparation: Proof-roll prepared sub-base surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.
- D. Remove loose material from compacted sub-base surface immediately before placing concrete.
- E. Edge Forms And Screed Construction: Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
- F. Check completed formwork and screeds for grade and alignment to following tolerances:
- G. Top of Forms: Not more than 1/8 inch in 10 feet.
- H. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.
- I. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.
- J. Placing Reinforcement: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.
- K. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

- L. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- M. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- N. Joints: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.
- O. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as shown on Drawings. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:
 - P. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.
 - Q. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into hardened concrete when cutting action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.
 - R. Inserts: Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.
- S. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.
- T. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.
- U. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- V. Isolation Joints: Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
- W. Locate expansion joints at intervals of 50 feet, unless indicated otherwise.
- X. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.
- Y. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

- Z. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
 - 1. Joint Schedule:
 - Expansion: Every 50 feet for walkways
 - Contraction: Every 10 feet for walkways unless indicated on drawings
Every 20 feet for loading aprons unless indicated on drawings

3.3 CONCRETE PLACEMENT:

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.
- C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- F. When concrete placing is interrupted for more than 1/2 hour, place a construction joint.
- G. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- H. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.
- I. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.
- J. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.
- K. Curbs And Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section,

lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

- L. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- M. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg.C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg.C) and not more than 80 deg F (27 deg.C) at point of placement.
- N. Do not use frozen materials or materials containing ice or snow.
- O. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- P. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.
- Q. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg.C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
- R. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
- S. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.4 CONCRETE FINISHING:

- A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiff granular texture.
- B. Burlap Finish: Drag a seamless strip of damp burlap across concrete, perpendicular to line of traffic, to provide a uniform gritty texture finish.
- C. Medium-To-Fine-Textured Broom Finish: Draw a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform fine line texture finish.
- D. Medium-To-Coarse-Textured Broom Finish: Provide a coarse finish by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
- E. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

- F. Concrete Protection And Curing: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.
- G. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.
- H. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- I. Curing Methods: Cure concrete by moisture curing, moisture- retaining-cover curing, curing compound, or a combination of these as follows:
 - 1 Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
 - 2 Water: Continuous water-fog spray. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.
 - 3 Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 4 Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
- J. Field Quality Control Testing: Utilize the Architect's testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. The Contractor will utilize the Architect's testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include the following:
 - 1 Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
 - 2 Slump: ASTM C143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
- K. Air Content: ASTM C231, pressure method; one test for each compressive-strength test but no less than one test for each day's pour of each type of air-entrained concrete.

- L. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F (4 deg.C) and below and when 80 deg F (27 deg.C) and above, and one test for each set of compressive-strength specimens.
- M. Compression Test Specimens: ASTM C31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
- N. Compressive-Strength Tests: ASTM C39; one set for each day's pour of each concrete class exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.
- O. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
- P. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
- Q. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
- R. Test results will be reported in writing to Architect/Engineer, concrete manufacturer, and Contractor.
- S. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- T. Additional Tests: The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect/Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Testing of materials not in compliance with project requirements will be at the expense of the Contractor.
- U. Repairs And Protection: Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section.
- V. Drill test cores where directed by Architect/Engineer when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to paving with epoxy adhesive.
- W. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

- X. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION 02520

SECTION 02567 - CATCH BASINS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK: This work includes the construction of all catch basins shown on the Drawings or as specified herein.

1.2 QUALITY ASSURANCE

A. Referenced Standards: Unless otherwise indicated, all referenced standards shall be the latest edition available at the time of bidding. Any requirements of these Specifications shall in no way invalidate the minimum requirements of the referenced standards.

1. ASTM A 48 Standard Specification for Gray Iron Castings
2. ASTM A 536 Standard Specification for Ductile Iron Castings
3. ASTM C 32 Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
4. ASTM C 144 Standard Specification for Aggregate for Masonry Mortar
5. ASTM C 150-99a Standard Specification for Portland Cement
6. ASTM C 207-91 Standard Specification for Hydrated Lime for Masonry Purposes
7. ASTM C 270-00 Standard Specification for Mortar for Unit Masonry
8. ASTM C 361 Standard Specification for Reinforced Concrete Low-Head Pressure Pipe
9. ASTM C 478 Standard Specification for Precast Reinforced Concrete Manhole Sections

1.3 SUBMITTALS:

A. Submit for approval shop drawings for catch basin frames, covers, grates, and steps. Submit for approval shop drawings for each type precast catch basin section.

PART 2 – PRODUCTS

2.1 MATERIAL: Unless otherwise noted on the Drawings, the Contractor has the option of providing catch basins constructed of brick or precast concrete.

- A. Catch Basin Bases, Cast-In-Place: Conform to the requirements of Section 03300 Cast-In-Place Concrete.
- B. Catch Basin Bases, Precast Concrete: Conform to the requirements of ASTM C 478.
- C. Catch Basin Sections, Precast Concrete: Precast concrete catch basin consists of a base section, riser sections, a transition and top. Provide pipe openings, of suitable size to fit the pipe, in the base section or riser sections as required. Conform to the requirements of ASTM C 478.

- D. Acceptance of the sections will be on the basis of material tests and inspection of the completed project.
- E. Catch Basin Steps, Cast Iron: Unless otherwise noted on the Drawings, provide the following cast iron steps conforming to the requirements of ASTM A 48:
1. Precast Concrete Catch Basin: Neenah Foundry R-1981-K, Sumter Machinery Co. Step No. 7, or equal.
 2. Brick Catch Basin: Neenah Foundry R-1980-J, Sumter Machinery Co. Step No. 9, or equal.
- F. Riser Joints: Provide riser joints of the rubber gasket type in which the gaskets are in compression and which will permit both longitudinal and angular movement. Design the bell and spigot ends to confine the gasket when the joint is in its final position. Provide each section with proper ends made of concrete formed on machined rings to insure accurate joint surfaces. The diameters of the joint surface, depended upon to compress the gasket, shall not vary from the theoretical diameters by more than 1/16 inch. Seal the joint with a rubber gasket so that the joint will remain tight under all conditions of service. Joints must be capable of withstanding an internal hydrostatic pressure of 10 psi. with no visible signs of leakage.
- G. Gaskets: Provide gaskets which conform to applicable sections of ASTM C 361. Use gaskets of a special rubber composition having a texture to assure a watertight and permanent seal and the product of a manufacturer having at least 5 years experience in the manufacture of rubber gaskets for pipe joints. Provide gaskets which are a continuous ring of flexible joint rubber of a composition and texture which are resistant to common ingredients of sewage, industrial wastes, and ground-water and which will endure permanently under the conditions likely to be imposed by this service.
- H. Frames, Covers, And Grates: Provide gray cast or ductile iron castings conforming to ASTM A 48 or ASTM A 536, respectively. Use castings for the catch basin frames, covers, and grates which are of good quality, strong, tough, even grained cast-iron, smooth, free from scale, lumps, blisters, sandholes and defects of every nature which would render them unfit for the service for which they are intended. Either machine horizontal bearing surfaces to true surfaces to prevent rocking or provide an approved non-rocking device.
1. Clean all castings thoroughly by shot blasting or some other approved method to provide an equal surface. Before shipping from the foundry, give castings one coat of coal-tar-pitch varnish, applied in a satisfactory manner so as to make a smooth coating which is tough, tenacious and not brittle or with any tendency to scale off. Castings may be subjected to a water-tight hammer test by the Engineer.
 2. Provide catch basin frames, covers, and grates designed to withstand a traffic wheel loading of 16,000 pounds/axle in accordance with current AASHTO specifications.

- I. Brick: Unless otherwise noted, provide standard size brick (8 inches long x 2-1/4 inches high x 3-5/8 inches wide), Grade SM, conforming to the requirements of ASTM C 32 except that the mean of 5 absorption tests must not exceed 8 percent by weight. Use brick which are sound, hard, uniformly burned, regular and uniform in shape and texture, and free of chips, cracks and other defects that impair strength or usefulness.
- J. Portland Cement: ASTM C 150, Type II. Use Type III high-early-strength as required for laying masonry in cold weather.
- K. Hydrated Lime: ASTM C 207, Type S.
- L. Aggregates: ASTM C 144 graded with 100% passing the No. 16 sieve.
- M. Water: Clean, free of deleterious materials which would impair strength or bond.
- N. Admixtures: Anti-freeze and accelerating compounds will not be allowed.

PART 3 – EXECUTION

- 3.1 INSPECTION: Examine the areas and conditions under which catch basins will be installed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.
- 3.2 BASES: Catch basin bases may be precast or cast-in-place as indicated on the Drawings. Invert channels may be formed in the concrete of the base or may be formed of brick and mortar upon the base. Insure that inverts conform accurately to the size of the adjoining pipes.
 - A. Curve side inverts and lay out main inverts (where direction changes) in smooth curves of the longest possible radii which are tangent to the side walls of the adjoining sewers at the plane midway between the invert and crown.
- 3.3 FRAMES, COVERS, AND GRATES: Set catch basin frames with the tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the Drawings or as directed. Set frames concentric with the top of the masonry and in a full bed of mortar so that the space between the top of the catch basin masonry and the bottom flange of the frame shall be completely filled with mortar and made watertight. Place a thick ring of mortar extending to the outer edge of the masonry all around the bottom flange. Finish the mortar flush with the top of the flange and with a slight slope to shed water away from the frame.
 - A. Leave catch basin covers or grates in place in the frames on completion of other work at the catch basin.
- 3.4 STUB OUTS FOR FUTURE LINES: Where stub outs are shown on the Drawings to indicate future lines, stub out short lengths (2 feet to 4 feet) of the bell end of pipe as directed by the Engineer. Use pipe of same type as used for other pipe entering the catch basin unless directed otherwise. Accurately set the stub to the required line and elevation

and encase the line in the catch basin wall. Close the open end of the pipe with a stopper sealed in with plastic joint compound.

3.5 PRECAST CATCH BASINS

- A. Precast Catch Basin Sections: Handle and install each section in such a manner and by such means as to prevent damage. Set sections vertical with sections and steps in true alignment.
- B. Install base sections on firm stabilized foundation so prepared to prevent settlement and misalignment. Place pipe openings at the exact elevation and location to receive entering pipes.
- C. Install riser sections, transitions and tops level and plumb with catch basin steps in true alignment. Make joints in accordance with manufacturer's instructions.
- D. After entering pipes are placed in the pipe openings and set to true alignment and grade, fill the annular space between the pipe and opening with a non-shrink grout to seal the joint watertight.
- E. Lift holes will be allowed in precast catch basin sections. After setting sections in place, thoroughly plug all holes in sections with mortar. Make mortar one part cement to 1-1/2 parts sand; mix with water until slightly damp to the touch (just short of balling) and hammer mortar into the holes until it is dense and an excess of paste appears on the surface. Then finish smooth and flush with the adjoining surfaces.

3.6 BRICK CATCH BASINS

- A. Mortar: Comply with the requirements of ASTM C 270. Unless directed otherwise by the Engineer, mix mortar in the following proportions (by volume):

1 part	Portland Cement
1/2 part	Hydrated Lime
4-1/2 parts	Sand
- B. Laying Brick: Use only clean brick. Moisten as directed until bricks are neither so dry as to absorb water from the mortar, nor so wet as to be slippery when laid. Lay each brick in a full bed of mortar without requiring subsequent grouting, flushing, or filling.
- C. Lay brick in level courses with mortar joints approximately 1/2" wide and uniform in thickness. Tool exposed joints and strike flush joints which will be plastered.
- D. Set entering pipe as the work progresses. Completely fill the space between the pipe and masonry to insure a watertight seal.
- E. Build steps into the catch basin and align so as to form a continuous ladder with the steps equally spaced vertically at not more than 16 inches on center. Embed steps into the wall a minimum of 3 inches and allow each step to project a minimum of 4 inches from the wall measured from the point of embedment.

- 3.7 PLASTERING AND CURING BRICK: Plaster outside face of masonry with mortar 1/2 inch thick. If required, moisten masonry prior to application of plaster. Carefully spread and trowel the plaster so that all cracks are thoroughly worked out. After hardening, check the plaster for bond and soundness by tapping. Remove and replace any unbonded or unsound plaster.
- 3.8 PROTECTION: Do not allow masonry and plaster to dry out rapidly; keep moist with burlap or other approved means. Protect masonry from weather and frost as required.

END OF SECTION 02567

SECTION 02630 - STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY: Work outlined in this section includes:

Trench excavation for storm drainage structures
Installation of stormwater pipe
Installation of stormwater structures

1.2 REGULATORY REQUIREMENTS: Conform to requirements of Lexington County Stormwater Ordinance and South Carolina Stormwater Management and Sediment Reduction Act. Conform to requirements of the SCDOT.

1.3 SECTION DESCRIPTION: The Contractor shall perform all work necessary for or incidental to the performance and completion of the storm drainage system. This work shall be completed as shown on the drawings and as specified in the Contract Documents. This work shall include the furnishing of all labor, materials and equipment. The Contractor shall be responsible for coordinating the work to assure that the work is completed in an orderly manner.

Although such work may not be specifically shown or specified, all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation shall be furnished and installed as part of this work.

PART 2 - PRODUCTS

2.1 GENERAL: PVC surface drainage inlets shall include the drain basin type as indicated on the contract drawing and referenced within the contract specifications. The ductile iron grates for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer. The surface drainage inlets shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc., or prior approved equal.

2.2 MATERIALS:

PVC: The drain basins required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the main body of the drain basin or catch basin. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454.

The grates and frames furnished for all surface drainage inlets shall be ductile iron for sizes 8", 10", 12", 15", 18", 24" and 30" and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface

drainage inlet. Grates for drain basins shall be capable of supporting H-20 wheel loading for traffic areas or H-10 loading for pedestrian areas. 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. Grates shall be provided painted black.

Concrete Pipe: Reinforced Concrete Gravity Storm Sewer Pipe will be in accordance with ASTM C 76. Testing of pipe to evaluate physical properties will be in accordance with ASTM C 497. Pipe will be Class III wall thickness "B." Joints will be filled with mortar composed of one part Portland Cement and two parts of clean sharp sand to which will be added fifteen percent (15%) hydrated lime. Joints may be of butyl material as approved by the Engineer in accordance with Federal Specification SS-S-10.5.

Corrugated Metal Pipe: Corrugated metal pipe shall be aluminum alloy with locked seams. Conforming to AASHTO M196 or AASHTO M211. The corrugation profile shall be:

<u>Diameter</u>	<u>Gage</u>	<u>Corrugation Profile</u>
18"	16	2 2/3" x 1/2"
24"	16	2 2/3" x 1/2"
30"	14	3" x 1"
36"	14	3" x 1"
42"	14	3" x 1"
48"	14	3" x 1"
54"	14	3" x 1"
60"	12	3" x 1"
72"	12	3" x 1"

High Density Polyethylene (HDPE) Corrugated Exterior/Smooth Interior Pipe: HDPE corrugated pipe, fittings and couplings shall have corrugated exterior and smooth interior walls and shall be in accordance with the following:

AASHTO M252: Specification for Corrugated Polyethylene Drainage Tubing, 3 to 10-inch diameter (with smooth interior wall).

AASHTO M294: Specifications for Corrugated Polyethylene Pipe, 12 to 36 inch diameter (Type S)

ASTM D1056: Specification for Flexible Cellular Materials - Sponge or Expanded Rubber

ASTM D1248: Specification for Polyethylene Plastics Molding and Extrusion Materials (Type III, Category 4, Grade P33, Class C)

ASTM D3350: Specification for Polyethylene Plastics Pipe and Fittings Materials (Cell Classification 324420C)

ASTM D2321: Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe

Pipe, fittings and couplings shall be Hi-Q pipe as manufactured by Hancor, Inc. of Findlay, Ohio or N-12 pipe as manufactured by Advanced Drainage Systems, Inc. (ADS) of Columbus, Ohio.

Perforated Pipe: When the plans call for perforated pipe, the perforations shall conform to the requirements of Class 1 perforations, as described in AASHTO M294-94.

Cement Mortar: Cement mortar shall be in accordance with ASTM C270 and shall one part Portland Cement (in accordance with ASTM C150, Type I), 1/4 to 1/2 part hydrated lime (ASTM C207, Type S), mortar aggregate (ASTM C144) in the amount of 2-1/4 to 3 times the sum of cement and lime and clean water. Mortar shall be mixed to proper consistency and applied within 2-1/2 hours after initial mixing and shall not be allowed to set.

Brick: Brick utilized shall be in accordance with ASTM C-62 for grade SW brick.

Catch Basin Frames & Grates: Catch basin frames and grates shall be manufactured as gray iron castings in accordance with ASTM A48, latest edition, Class 30 iron (minimum) or ductile iron in accordance with ASTM A536, latest edition. All castings shall be heavy duty suitable for H-20 loads. Grates shall be machined for a level fit (without rocking). Frames and grates shall be as shown on the plans and as manufactured by Sumter Machinery, Dewey Brothers, or Neenah Foundry. Manhole frames and covers shall be furnished and installed as discussed in Section 02530.

Concrete Block Structures: Concrete block structures shall be constructed as shown on the plans and in accordance with these specifications. Concrete blocks shall consist of one part Portland Cement, 1-1/4 to 2 parts fine aggregate, and four parts or less coarse aggregate. Block shall be steam cured and have a compressive 28-day strength of 2,500 psi (pounds per square inch) of cross-sectional area laid in the wall. The maximum average absorption rate of the block shall not exceed seven percent (7%) by weight and no individual unit shall exceed eight percent (8%) by weight. Concrete blocks shall be furnished by a manufacturer approved by the Engineer.

Precast Concrete Structures: Precast concrete structures may be constructed instead of brick or masonry structures. Precast structures shall be furnished by a manufacturer approved by the Engineer.

Steps: Steps installed in stormwater structures shall be as specified for Precast Manholes in Section 02530.

PART 3 - EXECUTION

- 3.1 General: Stormwater structures may be constructed of brick, block, poured-in-place concrete, precast concrete structures or a combination thereof.
- 3.2 Trench Excavation: Pipe trenches shall be of necessary widths for the proper laying of the pipe and the banks shall be as nearly vertical as practical. In paved areas the trench shall be vertical and sheeted, if required; the clearance between the pipe and trench wall or back of sheeting shall not exceed 18 inches. The bottom of the trenches shall be excavated to a depth of the outside bottom of the pipe barrel. Any over excavation shall

be replaced with suitable compacted material. Excavation for inlets and other appurtenances shall be sufficient to provide a clearance between their outer vertical surfaces and the face of the excavation or sheeting, if used, of not less than 12 inches.

Soft, spongy, or otherwise unstable material encountered below the established grade of the excavation which will not provide a firm foundation for subsequent work shall be removed and replaced as directed. Unless otherwise directed, all such unstable materials shall be removed for the full width of the excavation and replaced with approved fill material.

Where sheeting and bracing are necessary to prevent caving of the trench sidewalls or sidewalls of excavation for other structures, and to safeguard the workmen, the trench or excavation for other structures shall be dug to such width that the proper allowance is made for the space occupied by the sheeting and bracing to provide clearance as specified above.

- 3.3 PVC Installation: The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of class 2 material as defined in ASTM D2321. Bedding and backfill for surface drainage inlets shall be placed and compacted uniformly in accordance with ASTM D2321. The drain basin body will be cut at the time of the final grade. No brick, stone or concrete block will be required to set the grate to the final grade height. For H-20 load rated installations, a concrete ring will be poured under and around the grate and frame. The concrete slab must be designed taking into consideration local soil conditions, traffic loading, and other applicable design factors. For other installation considerations such as migration of fines, ground water, and soft foundations refer to ASTM D2321 guidelines.
- 3.4 Concrete Pipe Installation: All pipe shall be carefully laid true to the line and grade shown on the Drawings. Any deviation from true alignment or grade which would produce a gap exceeding 1/2-inch between section of pipe for more than 1/3 of the circumference of the inside of the pipe, will not be acceptable and where such occurs, the pipe shall be re-laid without additional compensation. No mortar, joint compound, or other filler which would tend to restrict the flexibility of the joint shall be applied to the gap. Pipes having defects that have not caused their rejection are to be so laid that these defects will be in the upper half of the sewer.

All pipes shall be laid with bells or grooves uphill. As the pipes are laid throughout the work, they must be thoroughly cleaned and protected from dirt and water. No length of pipe shall be laid until the two preceding lengths have been thoroughly embedded in place so as to prevent any movement or disturbance of the finished joint. No walking on or working over the pipes after they are laid, except as may be necessary in tamping earth and backfilling, will be permitted until they are covered to a depth of one (1) foot. Fill placed around the pipe shall be deposited on both sides simultaneously to approximately the same elevation and uniformly compacted. Whenever the pipe laying is discontinued, as at night, the unfinished end is to be securely protected from displacement due to caving of the banks or from other injury and a suitable stopper is to be inserted therein.

- 3.5 High Density Polyethylene (Hdpe) Pipe: High Density Polyethylene (HDPE) Corrugated Exterior/Smooth Interior Pipe shall be installed in accordance with the manufacturer's recommendations and these specifications.
- 3.6 Brick Masonry Structures: Stormwater catch basins, junction boxes and manholes constructed of brick masonry shall be constructed as shown on the plans and in accordance with these specifications.

Excavation for the structure shall be completed and the foundation set as shown on the plans. For concrete foundation see Section 03300 for additional information. Foundations must be solid and free from unsuitable materials.

The brick shall be thoroughly saturated with water and placed and boarded into the mortar by the "shove joint" method in such a manner as to thoroughly bond the structure. Joints shall be not less than on-quarter inch (1/4") and not greater than one-half inch (1/2") in thickness and the thickness shall be uniform throughout.

Backfilling shall be completed after the masonry has cured and compaction shall be completed in such a manner as to provide thorough compaction and not endanger the structure.

- 3.7 Drainage Structure Installation: Concrete inlets or other structures shall be constructed in conformity with the Drawings. Forms shall be designed and constructed so that they may be removed without injury to the concrete and shall be left in place for at least 24-hours after concrete is poured. Concrete shall be thoroughly tamped and shall be cured for at least five (5) days after removal of forms. Honeycomb places shall be thoroughly cleaned, saturated with water and pointed up with mortar.

Precast inlets or other structures may be used in lieu of cast-in-place structures. Grates are to be set in place in mortar to the proper line and grade.

End Of Section 02630

SECTION 02764 - PAVEMENT JOINT SEALANTS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.

1.2 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).
3. When joint substrates are wet or covered with frost.
4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 – PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by owner from manufacturer's full range.

2.2 COLD-APPLIED JOINT SEALANTS

- A. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.
- B. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
- C. Multicomponent Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.
- D. Available Products: Subject to compliance with requirements, cold-applied joint sealants that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete:
 - a. Vulkem 200; Mameco International.
 - b. Sonomeric 1; Sonneborn Building Products Div., ChemRex, Inc.
 - 2. Type NS Silicone Sealant for Concrete:
 - a. Roadsaver Silicone-SL; Crafcoc Inc.
 - b. 888; Dow Corning.
 - 3. Multicomponent Low-Modulus Sealant for Concrete and Asphalt:
 - a. SOF-SEAL; W.R. Meadows, Inc.

2.3 HOT-APPLIED JOINT SEALANTS

- A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.
- B. Available Products: Subject to compliance with requirements, hot-applied joint sealants that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Elastomeric Sealant for Concrete:

- a. Superseal 444/777; Crafc0, Inc.
- b. POLY-JET 3406; W.R. Meadows, Inc.

2.4 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- E. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 02764

SECTION 02930 - LOAMING, SEEDING AND SODDING

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to place loam, finish grade, apply lime and fertilizer, hydraulically apply seed and mulch, and maintain all seeded areas as shown on the Drawings and as specified herein, and to all grassed areas disturbed during the normal progression of the Work.
- B. Furnish all labor, materials, equipment and incidentals required and place loam, finish grade and furnish and install sod to all established lawn areas disturbed during the normal progression of the Work. Any seeding of these areas shall be considered temporary.
- C. Determination of placement of either seed or sod shall be at the sole discretion of the Owner/Engineer.

1.2 RELATED WORK

- A. Site Preparation is included in Section 02100.
- B. Trenching, Backfill and Compaction is included in Section 02221.

1.3 SUBMITTALS

- A. Submit, in accordance with Section 01300, complete shop drawings, materials and equipment furnished under this Section including seed mixtures and product label information.
- B. Samples of all materials shall be submitted for inspection and acceptance upon Owner/Engineer's request.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Loam shall be fertile, natural soil, typical of the locality, free from large stones, roots, sticks, clay, peat, weeds and sod and obtained from naturally well drained areas. It shall not be excessively acid or alkaline nor contain toxic material harmful to plant growth. Topsoil stockpiled under other Sections of this Division may be used, but the Contractor shall furnish additional loam at his/her own expense if required.
- B. Fertilizer shall be a complete commercial fertilizer 10-08-06 or 10-07-04 grade for grass areas. It shall be delivered to the site in the original unopened containers each showing the manufacturer's guaranteed analysis, properly labeled, and conforming to all applicable State laws. Store fertilizer so that when used it shall be dry and free flowing.

- C. Lime shall be ground limestone containing all the finer particles obtained in the grinding process and ground sufficiently fine so that not less than 80 percent will pass through a No. 8 sieve. The calcium carbonate equivalent must be at least 80 percent. One or both must be greater than 80 so that the multiplication of the percent of calcium carbonate equivalent by the percent of material passing through the No. 8 sieve will be equal to or be more than 0.72. The moisture content at the time of shipment must not exceed 8 percent.
- D. Grass seed shall be from the same or previous year's crop; each variety of seed shall have a percentage of germination not less than 90, a percentage of purity not less than 85 and shall have not more than 1 percent weed content. The classes of Seeding Mixture shall consist of one or more of the classes listed below. Seeding Mixtures from the specified class shall be designated by the Owner/Engineer, based on the season of the year when seeding operations are performed.

LOCATIONS	SEEDS	LBS./ACRE	SEASON TO USE
1 – Sunny	Bermuda, hulled	25	February through April
	Bermuda, unhulled	25	
	Rye grass, Italian	150	
2- Sunny	Bermuda, hulled	25	May through September 15
	Bermuda, unhulled	25	
	Millet, brown top	25	
3 – Sunny	Bermuda, unhulled	60	September 15 through February
	Rye grass, Italian	150	
4 – Shady	Substitute carpet grass for Bermuda in 1, 2 and 3	40	All Season
5 – Steep Slopes	Lespedeza, Sericea (Clay Soils) Add to 1, 2, 3 and 4	25	All Season

OR

6 - Steep Slopes	Love grass, weeping (Sandy Soils) Add to 1, 2, 3 and 4	30	All Season
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Use Dolomitic Limestone at one ton per acre.
 Use 500 lbs. of 10-10-10 Fertilizer per acre.

- E. The seed shall be furnished and delivered premixed in the proportions specified above. A manufacturer's certificate of compliance to the specified mixes shall be submitted by the manufacturer for each seed type. These certificates shall include the guaranteed percentages of purity, weed content and germination of the seed and also the net weight and date of shipment. No seed may be sown until the certificates have been submitted.

- F. Mulch shall be a specially processed cellulose fiber containing no growth or germination-inhibiting factors. It shall be manufactured in such a manner that after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a homogeneous slurry. When sprayed on the ground, the material shall allow absorption and percolation of moisture. Each package of the cellulose fiber shall be marked by the manufacturer to show the air-dry weight content.
- G. Sod shall be as grown by an established sod grower, as approved by the Engineer and shall consist of the following grasses:

<u>Botanical Name</u>	<u>Common Name</u>	<u>Percent</u>
Poa pratensis	Kentucky Bluegrass	90 to 100
Festuca rubra	Jamestown Fescue	0 to 10

1. Sod shall be vigorous, well rooted, healthy turf, free from insect pests, disease, weeds, other grasses, stones, bare spots, burned spots and any other harmful or deleterious matter. Sod shall be machine stripped at a uniform soil thickness of approximately 1-in and not less than 3/4-in. The measurement for thickness shall not include top growth and thatch and shall be determined at the time of cutting in the field.
2. Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2-in on width and plus or minus 5 percent on length. Broken rolls or torn or uneven rolls will not be acceptable.
3. Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section.
4. Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect survival.
5. Harvest, deliver and transplant sod within a period of 36 hours unless a suitable preservation method is approved by the Owner/Engineer prior to delivery. Sod not transplanted within this period shall be subject to inspection and approval by the Owner/Engineer prior to its installation.
6. Before stripping, mow sod uniformly at a height of 1-in to 2-1/2-in.

PART 3 EXECUTION

3.1 APPLICATION

- A. Unless otherwise shown on the Drawings, loam shall be placed to a minimum depth of 6-in on all lawn areas and 4-in in areas indicated to be naturalized.
- B. For all areas to be seeded:
 1. Lime shall be applied at the rate of 1.0 tons/acre.

2. Fertilizer shall be applied at the rate of 400 lbs/acre.
 3. Lawn grass seed shall be applied at the rate of 10 lbs/1,000 sq ft.
 4. Fiber mulch shall be applied at the rate of 20 lbs/1,000 sq ft.
- C. The application of fertilizer and lime shall be incorporated into soil to a depth of at least three (3) inches by discing, harrowing or other approved methods acceptable to the Owner/Engineer.
- D. The application of fertilizer and lime may be performed hydraulically in one operation with hydroseeding and mulching. If lime is applied in this manner, clean all structures and paved areas of unwanted deposits.

3.2 SEEDING INSTALLATION

- A. Schedules for seeding and fertilizing shall be submitted to the Owner/ Engineer for approval prior to the work.
- B. The subgrade of all areas to be loamed and seeded shall be raked and all rubbish, sticks, roots and stones larger than 2-in shall be removed. Subgrade surfaces shall be raked or otherwise loosened immediately prior to being covered with loam. Subgrade shall be inspected and approved by the Owner/Engineer before loam is placed.
- C. Loam shall be placed over approved areas to a depth sufficiently greater than required so that after natural settlement and light rolling, the complete work will conform to the lines, grades and elevations indicated. No loam shall be spread in water or while frozen or muddy.
- D. After loam has been spread, it shall be carefully prepared by scarifying or harrowing and hand raking. All large stiff clods, lumps, brush, roots, stumps, litter and other foreign material shall be removed from the loamed area and disposed of. The areas shall also be free of smaller stones, in excessive quantities, as determined by the Owner/Engineer. The whole surface shall then be rolled with a hand roller weighing not more than 100 lbs/ft of width. During the rolling, all depressions caused by settlement of rolling shall be filled with additional loam and the surface shall be regraded and rolled until a smooth and even finished grade is created.
- E. Seeding, mulching and conditioning shall only be performed during those periods within the seasons which are normal for such work as determined by the weather and locally accepted practice, as approved by the Owner/Engineer. Hydroseed only on a calm day.
- F. Seeding shall be done within 10 days following soil preparation. Seed shall be applied hydraulically at the rates and percentages indicated. The spraying equipment and mixture shall be so designed that when the mixture is sprayed over an area, the grass seed and mulch shall be equal in quantity to the specified rates. Prior to the start of work, the Owner/Engineer shall be furnished with a certified statement for approval as to the number of pounds of materials to be used per 100 gallons of water. This statement shall also specify the number of square feet of seeding that can be covered with the quantity of solution in the Hydroseeder.

- G. In order to prevent unnecessary erosion of newly graded slopes and unnecessary siltation of drainage ways, carry out seeding and mulching as soon as satisfactory completion of a unit or portion of the project. A unit of the work will be defined as not more than 20,000 sq ft.
- H. When protection of newly graded areas is necessary at a time that is outside of the normal seeding season, protect those areas by whatever means necessary (such as straw applied with a tar tack) or by other measures as approved by the Owner/Engineer.

3.3 SEEDING IN WOODED AND UNGRADED AREAS

- A. For preparation and seeding in wooded areas under this Contract and where no grading is required, all of the specified materials and procedures shall be utilized except that no disking shall be performed within the drip line of trees to be preserved. The seed bed shall be prepared by the addition of a thin layer of top soil roughly 1-in deep.

3.4 SOD INSTALLATION

- A. At locations specified, or shown on the plans, or designated by the Owner/Engineer, the Contractor shall carefully store the furnished sod. Upon compaction of the trench in a manner satisfactory to the Owner/Engineer, the sod shall be replaced in a neat, workman like manner, over a minimum of two (2) inches of loam. Any deficiency in sod necessary to restore the surface to a condition comparable to that which existed before construction operations began will be furnished by the Contractor unless other specified

3.5 MAINTENANCE AND PROVISIONAL ACCEPTANCE

- A. Keep all seeded areas watered and in good condition, reseeding if and when necessary until a good, healthy, uniform growth is established over the entire area seeded. Maintain these areas in an approved condition including a minimum of two mowings of the lawn areas until provisional acceptance.
- B. On slopes, provide against washouts by an approved method. Any washout that occurs shall be regraded and reseeded at the Contractor's expense until a good sod is established.
- C. The Owner/Engineer will inspect all work for provisional acceptance at the end of the 8-week grass maintenance period.
- D. A satisfactory stand will be defined as a section of grass of 10,000 sq ft or larger that has:
 - 1. No bare spots larger than 3 sq ft.
 - 2. No more than 10 percent of total area with bare spots larger than 1 sq ft.
 - 3. Not more than 15 percent of total area with bare spots larger than 6-in square.

- E. The inspection by the Owner/Engineer will determine whether maintenance shall continue in any area.
- F. After all necessary corrective work and clean-up has been completed, the Owner/Engineer will certify in writing the provisional acceptance of the lawn areas. Maintenance of lawns or parts of lawns shall cease on receipt of provisional acceptance.

3.6 GUARANTEE PERIOD AND FINAL ACCEPTANCE

- A. All seeded areas shall be guaranteed for not less than 1 full year from the time of provisional acceptance.
- B. At the end of the guarantee period, inspection will be made by the Owner/Engineer. Lawn areas not demonstrating satisfactory stands as outlined above, shall be renovated, reseeded and maintained meeting all requirements as specified herein.
- C. After all necessary corrective work has been completed, the Owner/Engineer shall certify in writing the final acceptance of the lawns.

END OF SECTION 02930