

TABLE OF CONTENTS

Division 11 – Equipment

115213 Outdoor Sports Equipment

Division 31 – Earthwork

310519.13 Geotextiles
312319 Dewatering
312333 Trenching and Backfilling
312500 Erosion and Sedimentation Controls

Division 32 - Exterior Improvements

321116 Subbase Courses
321313 Concrete Paving
321813 Synthetic Turf Playing Field System
329113 Soil Preparation
329200 Turf and Grasses

Division 33 – Utilities

330513 Manholes and Structures
334100.20 High Density Polyethylene Storm Utility Drainage Piping

SECTION 115213 – OUTDOOR SPORTS EQUIPMENT

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide equipment and materials and do work necessary to construct or provide the following as indicated on the Drawings and as specified. Work shall include but shall not be limited to:
 - 1. Football Equipment: Goal Post System.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Show application to project.
 - 2. Show fabrication and installation of backstop assembly and foul ball poles. Include plans, elevations, component details, and attachments to other Work.
- B. Provide sealed structural drawings by the qualified professional engineer for goalpost footings.
- C. Product Data: Submit manufacturer's product data and samples as noted for the following:
 - 1. Goal Post System.

1.3 QUALITY ASSURANCE

- A. Installer of outdoor sports equipment the playing field shall be the same Contractor. All installed equipment shall be under the supervision of Owner's groundskeeper.

1.4 WARRANTY

- A. General Warranty: Special warranties specified in this Section shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranties:
 - 1. Equipment: Written warranties, executed by the manufacturer of each piece of equipment specified agreeing to repair or replace equipment or components that fail in materials or workmanship with specified warranty period.

PART 2 – PRODUCTS

2.1 FOOTBALL EQUIPMENT

- A. Football Goal Post System with Foundation Box and Cover:
 - 1. Goal Posts and Appurtenances for the specific sport level by the following or approved equal:
 - a. Upright Height:
 - 1) 30 Feet.
 - b. Crossbar Width:
 - 1) 23 feet 4 inches.

- c. Gooseneck Depth:
 - 1) 8 feet Offset.
- d. Material:
 - 1) Aluminum.
 - 2) Steel.
- 2. Products and Suppliers:
 - a. Sportsfield Specialties, Inc. (www.sportsfieldspecialties.com):
 - 1) Goal System, Model No. GP 4383.
 - 2) Foundation Box and Cover, Model No. GP4570.
 - 3) Goal Post Pads, Model No. GP 4590 R Full, 18 ounce.
 - b. Triman Tele-Goal (800) 822-6886.
 - c. Gilman Gear:
 - 1) LNG23 (23 feet 4 inches wide), 8-foot offset, Gilman Gear.
 - d. UCS Sports and Recreation Equipment:
 - 1) 8-foot offset.
 - 2) (800) 526-4856.
 - e. Or approved equal.
- 3. Paint:
 - a. Football Goal Post to be Powder Coated Saturn Yellow.
- 4. Goal Post Pads
 - a. Provide Custom Graphics, graphic to be provided and selected by owner. Color to be selected by Owner.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. General: Install in accordance with manufacturers recommendations and approved shop drawings.
- B. Football Equipment:
 - 1. Football Goal Post System:
 - a. Install new equipment as per manufacturer's instructions for location, height of crossbar and level.
 - b. Contractor to submit drawing of footing sealed by a licensed engineer and approved prior to installation of footing or sleeve.

END OF SECTION

SECTION 310519.13 – GEOTEXTILES

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the installation of separation/stabilization fabric as shown on the Drawings and as specified herein.
-

1.2 QUALITY ASSURANCE

- A. The latest edition of the following standards, as referenced herein, shall be applicable.
 - 1. American Society for Testing and Materials (ASTM).

1.3 SUBMITTALS

- A. Product Data:
 - 1. Submit Manufacturer's material specifications, product literature and installation instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
 - 1. Deliver sufficient materials to the site to prevent interruption of the work.
 - 2. All materials shall be inspected by Contractor upon delivery. Contractor shall notify Engineer of any damage. Products received at the site torn, with holes, deteriorated, or otherwise damaged will not be approved and shall be returned and replaced at no expense to the Owner.
- B. Storage:
 - 1. All material shall be stored in strict accordance with the manufacturer's recommendations and as approved by the Engineer.
 - 2. Do not store products directly on ground. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure. Store geotextile in way that protects it from elements, if stored outdoors, elevate, and protect geotextile with waterproof cover.
- C. Handling:
 - 1. All material shall be handled in strict accordance with the manufacturer's recommendations and as approved by the Engineer.

PART 2 – PRODUCTS

2.1 WOVEN GEOTEXTILE

- A. Stabilization Fabric: To be used beneath roadways and walks.
- B. Composed of polymeric yarn interlaced to form a planar structure with uniform weave pattern.
- C. Calendared or finished so yarns will retain their relative position with respect to each other.

- D. Polymeric Yarn: Long-chain synthetic polymers (polyester or polypropylene) with stabilizer or inhibitors added to make filament resistant to deterioration due to heat and ultraviolet light exposure.
- E. Sheet Edges: Selvaged or finished to prevent outer material from separating from sheet.
- F. Unseamed Sheet Width: Minimum 12 feet.
- G. Physical Properties: Conform to requirements noted below:

PROPERTY	DESIGN VALUE	TEST METHOD
Tensile Strength	315 lbs	ASTM D4632
Elongation	12%	ASTM D4632
Trapezoidal Tear	113 lbs	ASTM D4533
CBR Puncture Strength	900 lbs	ASTM D6241
A.O.S.	40 (US Sieve)	ASTM D4751
Permittivity	.05 sec ⁻¹	ASTM D4491

2.2 NONWOVEN GEOTEXTILE

- A. Separation/Filtration Fabric: To be used in drainage ditches, haybale installation, culvert outfall installations, rip-rap outfall installations, and cover material separation
- B. Pervious sheet of polyester, polypropylene, or polyethylene fabricated into stable network of fibers that retain their relative position with respect to each other. Nonwoven geotextile shall be composed of continuous or discontinuous (staple) fibers held together through needle-punching, spun-bonding, thermal-bonding, or resin-bonding.
- C. Geotextile Edges; selvaged or otherwise finished to prevent outer material from pulling away from geotextile.
- D. Unseamed Sheet Width: Minimum 12 feet.
- E. Physical Properties: Conform to the requirements noted below:

PROPERTY	DESIGN VALUE	TEST METHOD
Tensile Strength	160 lbs	ASTM D4632
Elongation	50%	ASTM D4632
Trapezoidal Tear	60 lbs	ASTM D4533
CBR Puncture Strength	400 lbs	ASTM D6241
A.O.S.	70 (US Sieve)	ASTM D4751
Permittivity	1.4 sec ⁻¹	ASTM D4491

PART 3 – EXECUTION

3.1 GENERAL

- A. The Contractor shall be responsible for the installation, and seaming of geotextile fabric in accordance with the specifications and the manufacturer's recommendations, as approved by the Engineer.

3.2 SUBGRADE PREPARATION

- A. Surfaces to be covered with geotextile fabric shall be smooth and free of rocks, sticks, roots, sharp objects, and all debris that may damage the fabric. The surface to be covered shall be firm and unyielding, with no sudden changes or breaks in grade. There shall be no standing water or excessive moisture on the surface when the fabric is placed.
- B. The compacted subgrade shall be maintained in a smooth, uniform, and compacted condition during installation of the fabric.

3.3 GEOTEXTILE INSTALLATION

- A. The fabric shall be cleaned of all debris or other materials that may negatively affect the fabric's performance.
- B. Mechanical equipment shall not be permitted to operate directly on the fabric unless authorized to do so by the manufacturer and approved by the Engineer.
- C. Geotextile Placement:
 - 1. Fabric shall be placed as recommended by the manufacturer and approved by the Engineer on surfaces which have been prepared to conform with these Specifications and found acceptable for fabric installation.
 - 2. The fabric shall be placed as smooth and wrinkle-free as possible.
 - 3. When installing geotextile in trenches, swales, ditches, etc., overlap geotextile in the direction of flow.
 - 4. All areas of fabric damaged during installation as determined by the Engineer shall be repaired or replaced by the Contractor as specified at no additional cost to the Owner. Should the fabric be damaged during any step of the installation, the damaged section shall be repaired by covering it with a piece of fabric which extends at least 24 inches in all directions beyond the damaged area. The fabric shall be secured by sewing or bonding as approved by the Engineer.
 - 5. At time of installation, fabric will be rejected if it has defects, ribs, holes, flaws, deterioration, or damage incurred during manufacture, transportation, handling, or storage. Damaged materials shall be removed and replaced at no additional cost to the Owner.
 - 6. Fabric shall be placed with long dimension down slope.
 - 7. Fabric shall be protected at all times during construction from contamination by surface run-off and any fabric so contaminated shall be removed and replaced with uncontaminated fabric.
- D. Seams and Overlaps of Geotextile:
 - 1. All overlaps shall be a minimum of 18 inches (450 mm).

3.4 COVER MATERIALS OVER GEOTEXTILES

- A. Granular materials shall be placed on geotextiles as shown on the Drawings. During backdumping and spreading, a minimum depth of 6 inches of granular material shall be maintained at all times between the fabric and wheels of trucks or spreading equipment. All equipment used in spreading or traveling on the cover layer for any reason shall exert low ground pressures and shall be approved by the manufacturer and Engineer. Dozer blades, etc., shall not make direct contact with the fabric; however, if tears occur in the fabric during the spreading operation, the granular material shall be cleared from the fabric and the damaged area repaired as previously described.

- B. The granular material shall be spread in the direction of fabric overlap. Large fabric wrinkles which may develop during the spreading operations shall be folded and flattened in the direction of the spreading. Occasionally, large folds may reduce the fabric overlap width. Special care shall be given to maintain proper overlap and fabric continuity.
- C. All equipment spreading cover material or traveling on the cover layer shall avoid making sharp turns, quick stops, or quick starts.
- D. Fabric shall be covered as soon as possible after placement to minimize exposure to sunlight. Fabric shall not be exposed for more than 5 days.

3.5 DISPOSAL OF SCRAP MATERIALS

- A. On completion of installation, the Contractor shall legally dispose of all trash and scrap material off-site or in a location approved by the Owner and Engineer, remove equipment used in connection with the work herein, and shall leave the premises in a neat acceptable manner.

END OF SECTION

SECTION 312319 – DEWATERING

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes provisions for a dewatering system to continuously lower and control groundwater levels and hydrostatic pressures in order to maintain near-dry conditions for construction of the work as shown on the plans and specified herein.

1.2 SUBMITTALS

- A. Submit the following:
 1. Description: of proposed dewatering system.
 2. Layout: of dewatering system, including location of sumps, deep wells, well points, header pipes, pumps, discharge lines, and observation wells.
 3. Details: of dewatering system, including installation methods for deep wells, well points and observation wells, depths of wells, material descriptions, pipe sizes, intake screen sizes, and pump capacities.
 4. Estimate: of time required to lower groundwater levels after start of pumping

1.3 JOB CONDITIONS

- A. Site soil boring data and samples, soil laboratory testing, and any soil reports shall be made available to prospective bidders for study and review. Bidders must make their own interpretation of subsurface conditions that may affect methods or the cost of construction of the Work.

PART 2 – PRODUCTS

2.1 DEWATERING SYSTEM

- A. Provide a dewatering system of adequate size and capacity to lower and maintain the groundwater at the specified level. The system shall include standby pumps and power source for continuous operation.
 1. Dewatering system shall consist of wellpoints, deep wells, cut-off walls, riser pipes, swing joints, header lines, valves, pumps, discharge lines, and all other necessary fittings, accessories and equipment for a complete operating system. Provide hole punches, sand backfill, and clay plugs as required by soil conditions.
- B. Observation Wellpoints: Provide groundwater reading wells or piezometers to monitor the groundwater level, as indicated on the approved Shop Drawings or as directed by the Engineer.
- C. Sand: Clean concrete sand conforming to ASTM C33.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Install the observation well points at locations indicated on approved Shop Drawings or where directed by the Engineer. Install observation wellpoints in accordance with manufacturer's printed instructions and in accordance with approved Shop Drawings. Provide sand backfill around wellpoint. Test each observation wellpoint to verify that the installation is performing properly.
- B. Protect observation well standpipes from damage by construction operations and maintain accessibility to them. Maintain reading wells until groundwater is allowed to return to its normal level.

3.2 INSTALLATION

- A. Install the dewatering system in accordance with approved Shop Drawings and as required by site conditions. Locate elements of the system to allow a continuous dewatering operation without interfering with the installation of any permanent project Work.

3.3 OPERATION

- A. Keep the system in continuous operation from the time excavation is started in the dewatering area (or before if required by site conditions to lower the groundwater to the elevations specified) until the time backfilling is completed at least 2 feet above the normal groundwater level.
 - 1. Do not discontinue dewatering operations without specific approval from the Engineer.
 - 2. Rates of groundwater withdrawal during dewatering operations, shall at all times be below the rate at which soil particles are removed from the existing soils.
- B. In the event excavation proceeds subsequent to dewatering as specified above, and the groundwater level is found to be within two feet of the excavation, the dewatering Contractor shall immediately continue to dewater as specified herein, including, but not limited to, additional dewatering and monitoring facilities, at no additional cost to the Owner. The excavation shall not be allowed to proceed below groundwater.

3.4 FIELD CONTROL

- A. Maintain a careful check to detect any settlement in existing adjacent Work. Notify the Engineer of any signs of settlement. Establish settlement point bench marks and take periodic readings as directed. The Contractor shall take all such precautions and do any and all Work necessary to protect the stability and integrity of adjacent lands. Pavements, buildings, and utilities from settlement or other movement that may be caused by his dewatering operations. The Contractor shall be solely responsible for any damage or injury to adjacent lands, pavements, buildings, or utilities caused by his dewatering or other operations or his failure to use corrective or preventive procedures or methods.
- B. Take and record measurements of the groundwater in each reading and pumping well periodically and when directed by the Engineer.

3.5 DISCHARGE

- A. Dispose of all water removed from the excavation in such a manner as not to endanger public health, property, or any portion of the Work under construction or completed.
- B. Dispose of water in such a manner as to cause no inconvenience to others on or adjacent to the site.
- C. Convey water from the excavation in a closed conduit. Do not use trench excavations as temporary drainage ditches.
- D. Disposal of water shall be approved by the Engineer and shall not cause erosion or sedimentation to occur in existing drainage systems. All sedimentation or blocking of existing systems shall be thoroughly cleaned and returned to original condition by the Contractor at his own expense.
- E. Provide approved sediment traps when water is conveyed into water courses.

3.6 REMOVAL

- A. When system is no longer required, gradually decrease the pumping rate until the water table resumes its natural position so that the velocity of the returning groundwater will be low enough as not to carry fines with it.
- B. When the dewatering system is no longer required and when directed by the Engineer, dismantle and remove the system and all appurtenances from the site.

END OF SECTION

SECTION 312333 – TRENCHING AND BACKFILLING

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the excavation of trenching, backfilling, compacting, dewatering, excavation support and disposal, as shown on the Contract Drawings, and as herein specified.
- B. The Engineer will determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. The latest edition of the following standards, as referenced herein, shall be applicable.
 - a. State Specific Department of Transportation Construction Standards.
 - b. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)."
 - c. American Society for Testing and Materials (ASTM).
 - d. National Electric Code (NEC).
- B. The Contractor shall comply with the requirements for soil erosion and sedimentation control and other requirements of governmental authorities having jurisdiction, including the State.
- C. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications in accordance with Section "Quality Requirements."

1.3 SUBMITTALS

- A. Samples:
 - 1. The Contractor shall furnish representative earth materials to the testing laboratory for analysis and report, as directed by the Engineer, or as outlined in the specifications.
- B. Test Results:
 - 1. The testing laboratory shall submit written reports of all tests, investigations, findings, and recommendations to the Contractor and the Engineer.

1.4 PROJECT REQUIREMENTS

- A. Notify the Engineer of any unexpected subsurface condition.
- B. Protect excavations by shoring, bracing, sheet piling, or by other methods, as required to ensure the stability of the excavation. Comply with OSHA requirements.
- C. Underpin or otherwise support structures adjacent to the excavation, which may be damaged by the excavation. This includes service lines.

- D. Protection of Existing Utilities:
 1. Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations. Comply with OSHA requirements.
 2. Coordinate interruption and/or termination of utilities with the utility companies and the Owner.
 3. Provide a minimum of 48 hours' notice to the Owner and receive written notice to proceed before interrupting any utility.

- E. Demolish and completely remove from the site any existing underground utilities designated to be removed, as shown on the Drawings or as specified.

- F. Repair any damaged utilities as acceptable to the Owner, Engineer, and utility company at no additional cost to the Owner.

- G. Contractor shall comply with maintenance and protection requirements as approved by the authority having jurisdiction.

- H. Protection of Persons and Property:
 1. Barricade open excavations occurring as part of this work and post with warning lights, if required.
 2. Operate warning lights as recommended by authorities having jurisdiction.
 3. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 4. Perform excavation within drip-line of trees to remain by hand, and protect the root system from damage or dryout to the greatest extent possible. Maintain moist conditions for root system and cover exposed roots with burlap. Paint cut roots of 1-inch diameter and larger with emulsified asphalt tree paint.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Pipe Zone Bedding: Select mixture of graded crushed stone, free from organic, frozen or other deleterious materials, conforming to the requirements of State Specific DOT Standards and meeting the following gradation requirements:

SIEVE	PERCENT PASSING
1-1/2"	100
1"	90 – 100
1/2"	0 – 15

- B. Pipe Zone Backfill: Sound, durable sand, gravel, stone or blends of these materials, free from organic, frozen or other deleterious materials, conforming to the requirements of State Specific DOT Standards and meeting the following gradation requirements:

SIEVE	PERCENT PASSING
2"	100
1/4"	30 – 65

SIEVE	PERCENT PASSING
No. 40	5 – 40
No. 200	0 – 10

- C. Suitable Material: Sound, durable sand, gravel, stone or blends of these materials, free from organic, frozen or other deleterious materials, conforming to the requirements of State Specific DOT Standards and meeting the following gradation requirements:

SIEVE	PERCENT PASSING
4"	100
No. 40	0 – 70
No. 200	0 – 15

1. Run-of-trench material, meeting the above criteria, shall be considered suitable material and shall be used for trench backfill only after tested in accordance with Section "Quality Requirements" and approved by the Engineer. The Contractor shall pay for all additional testing required to determine the conformance of run-of-trench material, if at any time during the Work this material appears to be in non-conformance in the opinion of the Engineer.

PART 3 – EXECUTION

3.1 PRECONSTRUCTION MATERIAL QUALIFICATION TESTING

A. General:

1. Sufficient size samples shall be obtained from the potential borrow source to allow completion of tests listed in paragraph B below. Samples may be obtained from test borings, test pits, or from borrow pit faces provided that surficial dry or wet soil is removed to expose undisturbed earth. Tests listed below shall be performed on each sample obtained. A minimum of 3 representative samples from each potential borrow source shall be furnished to the testing laboratory for prequalification testing. Test data shall be provided to the Engineer a minimum of 2 weeks prior to construction for approval of borrow source. Three test reports completed within three months prior to construction may be submitted for commercial earth borrow sources or suppliers of stone products (crushed stone or graded stone products) in lieu of prequalification tests as approved by the Engineer.

B. Material Tests:

1. Particle Size Analysis:
 - a. Method: ASTM D422.
 - b. Number of Tests: One (1) per sample; three (3) per potential source.
 - c. Acceptance Criteria: Gradation within specified limits.
2. Maximum Density Determination:
 - a. Method: ASTM D1557 - Modified Proctor.
 - b. Number of Tests: One (1) per sample; three (3) per potential source.
3. Re-establish gradation and maximum density of fill material if source is changed during construction.

3.2 PREPARATION

- A. Establish required lines, levels, contours, and datum.
- B. Maintain benchmarks and other elevation control points; re-establish if disturbed or destroyed at no additional cost to the Owner.
- C. Establish location and extent of existing utilities prior to commencement of excavation.

3.3 EXCAVATION

- A. All excavation shall be made to such depth as required and of the width shown on the Drawings to provide suitable room for building the structures and laying the pipe(s) they are to contain and for sheeting, shoring, pumping and draining as necessary, and for removing peat, silt, or any other materials which the Engineer may deem unsuitable. Hand trench excavation may be required to protect existing utilities and structures.
- B. Trench excavation for pipes shall be made by open cut to accommodate the pipe or structure at the depths indicated on the Drawings. Excavation shall be made to such a depth and to the width indicated on the Drawings so as to allow a minimum of 8 inches of pipe zone bedding to be placed beneath the bottom of all structures and barrels, bells or couplings of all pipes installed unless otherwise specified on the Drawings.
- C. The bottom of the trench shall be accurately graded to provide a uniform layer of bedding material as required for each section of pipe. Trim and shape trench bottoms and leave free of irregularities, lumps, and projections.
- D. Stockpile excavated subsoil for reuse where directed or approved.
- E. Over excavation/undercut: If, in the opinion of the Engineer, existing material below the trench grade is unsuitable for properly placing bedding material and laying pipe, the Contractor shall excavate and remove the unsuitable material and replace the same with an approved pipe zone bedding material properly compacted.
- F. Stability of Excavation: Slope sides of excavations shall comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavation in safe condition until completion of backfilling.
- G. Removal of materials beyond the indicated subgrade elevations, without authorization by the Engineer, shall be classified as unauthorized excavation and shall be performed at no additional cost to the Owner.

3.4 DEWATERING

- A. The Contractor shall remove all water from the excavation promptly and continuously throughout the progress of the work and shall keep the excavation dry at all times until the work is completed and excavation is backfilled or have sufficient weight to resist uplift pressures. Groundwater levels shall be depressed to a minimum of 2 feet below excavation subgrade. No pipe or structure is to be laid in

water and water shall not be allowed to rise on or flow over any pipe or structure until such time as approved by the Engineer.

- B. Provide a suitable point of discharge from dewatering operations shall be conveyed in a non-erosive manner satisfactory to the Engineer.
- C. Precautions shall be taken to protect uncompleted work from flooding during storms or from other causes. All pipe lines or structures not stable against uplift during construction or prior to completion shall be thoroughly braced or otherwise protected.

3.5 BEDDING AND BACKFILLING

- A. All pipe trenches backfill (pipe zone bedding, pipe zone backfill and trench backfill) shall be compacted by tamping or rolling to achieve a minimum dry density of 90 percent of the modified Proctor maximum dry density of the material used (ASTM D1557). Backfill in pipe trenches to be covered with pavement shall be compacted to a minimum of 95 percent of modified Proctor maximum dry density. Backfill materials shall be placed with water content within plus or minus 4 percent of optimum moisture content per the modified Proctor method (ASTM D1557). Any water used for compaction shall be provided by the Contractor at his own expense. The Contractor is responsible for the repair of any trench settlement at no expense to the owner.
- B. Bedding and backfilling shall be accomplished in three stages unless otherwise specified on the Contract Drawings. The first stage shall involve placement of "pipe zone bedding" as a layer(s) of selected material required to support, or to stabilize unsound or unsatisfactory foundation conditions. The second stage shall involve placement of "pipe zone backfill" from the top of the bedding material up to 1 foot above the pipe. The third stage involves the placement of "trench backfill" in the remainder of the trench up to the surface of the ground or the bottom of any special surface treatment subgrade elevation.
- C. The bedding material shall be placed in the trench after the trench has been excavated a minimum of 8 inches below the bell of the pipe to permit the placing of not less than 8 inches of bedding material unless otherwise specified on the Drawings. Where, in the opinion of the Engineer, more than 8 inches of bedding material shall be required, the excavation shall be performed and bedding placed to the depth ordered by the Engineer.
- D. Provide uniform bearing and support for each section of pipe at every point along the entire length except where necessary to excavate for bell holes, pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make the joint connection properly.
- E. The bedding material shall be placed to the full width of trench. The bedding material shall be placed in loose lifts not exceeding 6 inches to the elevation shown on the Drawings or directed by the Engineer. The bedding material shall be tamped and compacted to form a firm and even bearing surface.
- F. Pipe zone backfill shall be placed to the elevation shown on the Drawings in loose lifts not-to-exceed 6 inches in thickness, before compaction. The backfill shall be placed on both sides of the pipe at the same time and to approximately the same elevation. Any pipe that is damaged or moved out of alignment, regardless of cause, shall be replaced or realigned at the Contractor's expense. Each layer shall be thoroughly compacted by hand-tamping or mechanical means being careful not to damage the pipe. When the pipe zone backfill reaches 1 foot over the top of the pipe, the entire surface shall be compacted by mechanical means.

- G. The remainder, if any, of the trench above the pipe zone backfill shall be backfilled with suitable material in loose lifts not exceeding 6 inches in thickness before compaction. Each layer shall be thoroughly compacted by mechanical means.

3.6 BACKFILLING AROUND STRUCTURES

- A. The Contractor shall not place backfill against any structure without obtaining the approval of the Engineer. No dumping shall be allowed where materials would flow against or around such structures. Backfill material shall be deposited in horizontal layers not exceeding 6 inches in loose thickness or as shown on the Drawings and thoroughly compacted by hand or by mechanical means to the satisfaction of the Engineer.

3.7 SUSPENSION OF WORK

- A. Whenever the work is suspended, excavations shall be protected and the roadways, if any, left unobstructed. Within or adjacent to private property, material shall be stored at such locations as will not unduly interfere with traffic of any nature and in no case shall materials be stored in locations which will cause damage to existing improvements.

3.8 DISPOSAL OF MATERIAL

- A. Excess and unsuitable materials shall be disposed of by the Contractor on the site in an area approved by the Engineer or legally disposed of off- site at the Contractor's expense.

3.9 FIELD QUALITY CONTROL

- A. Notify the Engineer at least 3 working days in advance of all phases of filling and backfilling operations.
- B. In-place density testing shall be performed to ascertain the compacted density of the fill and backfill materials in accordance with the following methods:
 - 1. In-place relative density:
 - a. Method: AASHTO T238, Nuclear Method.
- C. Perform initial density testing to verify that contractors proposed compaction effort will obtain the minimum required densities.
- D. In-place density tests on trench backfills shall be provided for every 500 cubic yards of fill and in vertical lifts not exceeding 2 feet and at least once daily.
- E. One particle size analysis (ASTM D422) and one modified Proctor compaction test (ASTM D1557) shall be completed for every 5,000 cubic yards of material placed.
- F. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions, at the Contractor's expense.
- G. Acceptance Criteria: The criteria for acceptability of in-place fill shall be in-situ dry density and moisture content. If a test fails to qualify, the fill shall be further compacted and re-tested. Subsequent test failures shall be followed by removal and replacement of the material.

END OF SECTION

SECTION 312500 – EROSION AND SEDIMENT CONTROL

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section covers work necessary for stabilization of soil to prevent erosion and sedimentation during and after construction and land disturbing activities. The work shall include the furnishing of all labor, materials, tools, and equipment to perform the work and services necessary as herein specified and as indicated on the Drawings. This shall include installation, maintenance, and final removal of all temporary soil erosion and sediment control measures. All erosion and sediment control methods and devices used shall conform to the latest requirements imposed by federal, state, and local authorities.
 - B. Comply with the latest version of the State Specific Erosion Control Manual.
 - C. The minimum areas requiring soil erosion and sediment control measures are indicated on the Drawings. The right is reserved to modify the use, location, and quantities of soil erosion and sediment control measures based on activities of the Contractor and as the Engineer considers to be the best interest of the Owner.
 - D. The Contractor shall be responsible for repair of any damage caused and shall be financially responsible for any penalties imposed.
-

1.2 QUALITY ASSURANCE

- A. Soil erosion and sediment control measures shall be implemented in accordance with the requirements and procedures outlined in this Specification, Contract Drawings and documents, state standards or guidelines for soil erosion and sediment control, and all regulatory authorities having jurisdiction. Where conflicts between requirements exist, the more restrictive rules shall govern.
- B. The Contractor shall provide all temporary control measures shown on the Drawings, or as directed by the Owner, Owner's representative, or soil conservation district for the duration of the contract. Erosion and sediment control Drawings are intended to be a guide to address the stages of work shown. Additional measures not specified on the Drawings may be necessary and shall be implemented to address intermediary stages of work and any conditions that may develop during construction at no cost to the Owner.
- C. Temporary control provisions shall be coordinated with permanent erosion control features to the extent practical to assure economical, effective, and continuous erosion and sediment control throughout the construction and post-construction period.
- D. Soil erosion and sediment control measures shall at all times be satisfactory to the Owner's Representative. Owner's Representative will inform the Contractor of unsatisfactory construction procedures and operations if observed. If the unsatisfactory construction procedures and operations are not responded to and corrected within 48 hours, the Owner's Representative may suspend the performance of any or all other construction until the unsatisfactory condition has been corrected. Such suspension shall not be the basis of any claim by the Contractor for additional compensation nor for an extension of time to complete the work. Any complaints, fines, etc. relating to ineffective erosion control, shall be the sole responsibility of the Contractor.

- E. The Contractor shall inspect all soil erosion and sediment control measures at least at the beginning and end of each day to ascertain that all devices are functioning properly during construction. Maintenance of all soil erosion and sediment control measures on the project site shall be the responsibility of the Contractor until final stabilization is complete, and until the permanent soil erosion controls are established and in proper working condition.
- F. The Contractor shall protect adjacent properties and watercourses from soil erosion and sediment damage throughout construction.

1.3 GENERAL

- A. Soil erosion stabilization and sediment control measures consist of the following elements:
 - 1. Maintenance of existing permanent or temporary storm drainage piping and channel systems, as necessary.
 - 2. Installation and maintenance of stabilized construction entrance(s).
 - 3. Construction of new permanent and temporary storm drainage piping and channel systems, as necessary.
 - 4. Construction of temporary erosion control facilities such as silt fences, check dams, etc.
 - 5. Topsoil and Seeding: Placement and maintenance of Temporary Seeding on all areas disturbed by construction. Placement of permanent topsoil, fertilizer, and seed, etc., in all areas not occupied by structures or pavement unless shown otherwise.
 - 6. Soil Stabilization Seeding: Placement of fertilizer and seed, etc., in areas as Specified hereinafter.
- B. The Contractor shall be responsible for phasing Work in areas allocated for his exclusive use during this Project, including any proposed stockpile areas, to restrict sediment transport. This will include installation of any temporary erosion control devices, ditches, or other facilities.
- C. The areas set aside for the Contractor's use during the Project may be temporarily developed to provide satisfactory working, staging, and administrative areas for his exclusive use. Preparation of these areas shall be in accordance with other requirements contained within these Specifications and shall be done in a manner to both control all sediment transport away from the area.
- D. Stockpiles remaining in place longer than 14 calendar days shall be considered permanent stockpiles for purposes of erosion and sediment control.
- E. All permanent stockpiles shall be seeded with soil stabilization seed and protected by construction of silt fences completely surrounding stockpiles and located within 10 feet of the toes of the stockpile slopes.
- F. Sediment transport and erosion from working stockpiles shall be controlled and restricted from moving beyond the immediate stockpile area by construction of temporary toe-of-slope ditches and accompanying silt fences as necessary. The Contractor shall keep these temporary facilities in operational condition by regular cleaning, regrading, and maintenance.
- G. The Contractor shall maintain all elements of the Soil Erosion Stabilization and Sedimentation Control systems and facilities to be constructed during this Project for the duration of his activities on this Project.
- H. Formal inspections made jointly by the Contractor and the Engineer shall be conducted every 2 weeks to evaluate the Contractor's conformance to the requirements of these Specifications.

- I. Replacement or repair of failed or overloaded silt fences, check dams, or other temporary erosion control devices shall be accomplished by the Contractor within 24 hours after receiving written notice from the Engineer.
- J. If the Contractor has not complied with any of the above maintenance efforts to the satisfaction of the Engineer within 2 working days after receiving written notification from the Engineer, the Owner shall have the prerogative of engaging others to perform any needed maintenance or cleanup, including removal of accumulated sediment at constructed erosion control facilities, and deduct from the Contractor's monthly partial payment the costs for such efforts in accordance with the General Conditions of the Contract.

1.4 SUBMITTALS

- A. Submittals shall be made in accordance with Section "Submittal Procedures."
- B. Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.
- C. Results of all tests and investigations, including recommendations.
- D. Submit product data, samples, specifications and manufacturer's installation procedures for approval as directed by Engineer prior to use.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Contractor shall provide all materials necessary to perform the work in accordance with the SWPPP or as shown on the Drawings or specified herein.

2.2 PERMANENT SEED

- A. Refer to Section "Turf and Grasses."

2.3 SOIL STABILIZATION AND TEMPORARY SEED

- A. Temporary Seed: Rye grass, cereal grasses, or other quick growing species suitable to the area as a temporary cover, which will not compete with the grasses specified for permanent cover.

2.4 TOPSOIL

- A. Topsoil shall be as specified under Section "Soil Preparation."

2.5 FERTILIZER

- A. Refer to Section "Turf and Grasses."

2.6 LIME

- A. Ground dolomite limestone not less than 85 percent total carbonates and magnesium, ground so that 50 percent passes through a No. 100 mesh sieve and 90 percent passes a No. 20-mesh sieve. Coarser material will be acceptable provided the specified rates of application are increased proportionately on the basis of quantities passing the No. 100-mesh sieve.

2.7 STRAW MULCH

- A. Threshed straw of oats, wheat, barley, or rye, free from seed of noxious weeds or clean salt hay.

2.8 HAY BALE

- A. Bales shall be tightly bound, staked with 1 inch by 1 inch hardwood stakes. Hay shall be from mowings of acceptable herbaceous growth free from noxious weeds.

2.9

2.9 SILT FENCE

- A. Silt Fence (SF) shall consist of woven geotextile fabric, posts, wire mesh backing, and fasteners meeting the requirements shown on the Drawings.

PART 3 – EXECUTION

3.1 GENERAL

- A. The Contractor shall comply with and implement the Stormwater Pollution Plan provided in the contract documents.
- B. Review the soil erosion and sediment control Drawings as they apply to current conditions. Any deviation from the Drawings must be submitted for approval to the site Engineer in writing at least 72 hours prior to commencing that work.
- C. Initial soil sediment and erosion control devices shall be in place prior to any land disturbing activity in their proper sequence and maintained until permanent protection is established.
- D. The limit of the area of any earthwork operations in progress shall be commensurate with the Contractor's capability and progress in keeping the finished grading, mulching, seeding, and other such permanent control measures current and in accordance with the accepted schedule for construction phasing. Should seasonal limitations make such coordination unrealistic, as determined by the Owner's Representative, temporary erosion control measures shall be provided immediately by the Contractor at no expense of the Owner.
- E. Temporary erosion control measures shall be used to correct conditions which develop during construction that are needed prior to installation of permanent control features, or that are temporarily needed to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.
- F. The Contractor shall incorporate all permanent erosion control features (stabilization) into the project at the earliest practical time to minimize the need for temporary controls.

- G. A stabilized construction entrance (SCE) shall be installed and maintained at any point where construction vehicles enter a public right-to-way, street, or parking area. The SCE shall be used to eliminate mud from the construction area onto public right-of-way. The SCE shall be constructed as shown on the Drawings. Any mud or debris tracked on streets shall be cleaned up immediately.
- H. Dust Control: The Contractor shall provide a commercial grade; enclosed broom mechanical street sweeper to control sediment and/or dust that is tracked on to the adjacent streets. The street sweeper shall be equipped with a water storage tank to wet the area prior to sweeping. Where on site controls do not prevent material from being tracked on to adjacent streets, the street sweeper shall be used to clean the adjacent streets immediately. In addition, at a minimum, the adjacent streets shall be swept at the end of each week or as directed by the Engineer.
- I. Any disturbed or stockpiled areas that will be left exposed more than 14 days or less according to State General Stormwater Permits shall immediately receive temporary or permanent seeding. Mulch/straw shall be used if the season prevents the establishment of a temporary cover. Disturbed areas shall be limed and fertilized prior to temporary seeding.
- J. Permanent vegetation shall be established as specified on all exposed areas within 7 days or less according to State General Stormwater Permits after final grading. Mulch as necessary for seed protection and establishment. Lime and fertilize seedbed prior to permanent seeding.
- K. Slopes shall be permanently seeded and mulched. Any slopes that erode easily shall be temporarily seeded and mulched. Any slopes deeper than 3:1 or steeper or as indicated on Drawings shall be protected with Erosion Control Blanket per specifications.
- L. All storm drainage outlets must be stabilized, as specified, before the discharge points become operational. Equip all inlets with inlet protection immediately upon construction.
- M. Discharge from dewatering operations for the excavated areas shall not be directed to surface waters without first properly removing the suspended sediment through filtration and/or settlement. The Contractor shall obtain any required permits associated with dewatering activities.
- N. Silt fence shall be installed at locations on the Drawings and any additional locations necessary for proper sediment control. The Contractor shall maintain the silt fence until the project is stabilized and shall remove and dispose of the silt fence and silt accumulation when 1/3 the height of the fence is reached.
- O. Soil erosion and sediment control shall include but not be limited to the approved measures. The Contractor shall be responsible for providing all additional measures that may be necessary to accomplish the intent of the Drawings.
- P. Comply with all other requirements of authorities having jurisdiction.
- Q. Soil Stabilization and Temporary Seeding:
 - 1. Soil stabilization seeding shall consist of the application of the following materials in quantities as further described herein for stockpiles and disturbed areas left inactive for more than 14 days.
 - a. Lime.
 - b. Fertilizer.
 - c. Seed.
 - d. Mulch.
 - e. Maintenance.

2. Hydroseeding will be permitted as an alternative method of applying seed and associated soil conditioning agents described above. Should the Contractor elect to apply soil stabilization seeding by hydroseeding methods, he shall submit his operational plan and methods to the Engineer.
 3. Temporary Seeding is to be placed and maintained over all disturbed areas prior to Permanent Seeding. Maintain Temporary Seeding until such time as areas are approved for Permanent Seeding. As a minimum, maintenance shall include the following:
 - a. Fix-up and reseeding of bare areas or re-disturbed areas.
 - b. Mowing for stands of grass or weeds exceeding 6 inches in height.
- R. Topsoil and Permanent Seeding: conform to the requirements of Section “Soil Preparation” and Section “Turf and Grasses.”

END OF SECTION

SECTION 321116 – SUBBASE COURSES

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes provisions for prepared subbase courses for under walks and pavements.
 - B. Proof rolling of subgrade for walks and pavements is included in this Section.
 - C. Final grading of pavement subbase is specified in this Section.
 - D. Stabilization fabric is included in another Section.
-

1.2 REFERENCES

- A. Applicable State DOT Standard Specifications.
- B. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).
- C. American Society for Testing and Materials (ASTM).

1.3 SUBMITTALS

- A. Source Quality Control Test Reports: Submit test reports directly to Engineer from the testing agency with copy to Contractor.
- B. Field Testing Reports: Submit results of field testing directly to Engineer with copy to Contractor. Reference testing location to plan, and cross-reference to all retesting required to accept installed subbase material.
 - 1. Note action taken next to all sub-standard test results.

1.4 QUALITY ASSURANCE

- A. Testing Laboratory Qualifications: To qualify for acceptance, the soil testing laboratory must demonstrate to Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct the required testing without delaying the progress of the Work.
- B. Field Testing and Inspection Service: Contractor shall retain the services of the same independent soil testing laboratory used for source qualification testing to provide soil testing during pavement subbase installation.

PART 2 – PRODUCTS

2.1 SOURCE QUALIFICATION TESTING

- A. Contractor shall employ and pay for a qualified independent soil testing laboratory to perform soil testing services for source qualification.

1. Obtain a 100-pound minimum representative sample from each potential aggregate source. Obtain samples for each different material gradation known to exist in the pit. Mix each sample thoroughly in accordance with AASHTO T87, and submit to the testing laboratory for reduction to specimen size. The laboratory shall perform the following tests in the order shown. Each material shall pass all tests in order to qualify.
 - a. Particle Size Analysis:
 - 1) Method: ASTM D422.
 - 2) Number of Tests: 2 per potential source.
 - 3) Acceptance Criteria: Gradation within specified limits.
 - b. Plasticity Index Determination:
 - 1) Method: ASTM D424.
 - 2) Number of Tests: 1 particle size analysis on material passing no 40 mesh.
 - 3) Acceptance Criteria: Plasticity Index within specified limits.
 - c. Maximum Density Determination:
 - 1) Method: ASTM D1557 Modified Proctor.
 - 2) Number of Tests: 2 per potential source.
 - d. Magnesium Sulfate Soundness Loss Test:
 - 1) Method: Standard Test Method.
 - 2) Number of Tests: 2 per potential source.
 - 3) Acceptance Criteria: 4 cycle loss within specified limits.
2. Re-establish subbase material properties if source is changed during construction.

2.2 MATERIALS

- A. Processed Gravel Subbase Course: Materials shall consist of sound, durable blast furnace slag, stone, sand, gravel or blends of these materials.
- B. Crushed Rock Subbase Course: Materials shall consist solely of approved blast furnace slag or stone which is the product of crushing ledge rock.
- C. All materials shall be well graded from course to fine and free from organic or other deleterious materials, and meeting the following gradation requirements:

SIEVE	PERCENT PASSING
2"	100
1/4"	25-60
No. 40	5-40
No. 200	0-10

1. Magnesium Sulfate soundness loss after 4 cycles shall be less than 20 percent.
2. Plasticity Index of material passing No. 40 sieve shall not exceed 5.0.
3. Not more than 30 percent, by weight, of the particles retained on a 1/2 inch sieve shall consist of flat or elongated particles. A flat or elongated particle is defined as one which has its greatest dimension more than 3 times its least dimension.
4. All material shall meet the specified gradation prior to placement. All processing shall be completed at the source.
5. Stabilization Fabric: Conform to Section "Geotextiles"

PART 3 – EXECUTION

3.1 PREPARATION

- A. Establish required lines, levels, contours, and datum.
- B. Maintain benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to Owner.
- C. Proof-roll existing subgrade to the satisfaction of the Engineer. Should the subbase course become unstable at any time prior to the placement of the overlying course(s), correct the unstable condition to the satisfaction of the Engineer. Replace unstable or weak subgrade materials with suitable material as provided in the Specifications.
- D. Place stabilization fabric in locations as directed on the plans and in accordance with Section “Geotextiles” after subgrade has been proof-rolled and accepted by the Engineer.

3.2 INSTALLATION

- A. Place subbase material in uniform horizontal layers, with a maximum compacted thickness of 12 inches.
- B. Place subbase in a manner to avoid segregation. Uncontrolled spreading shall not be permitted.

3.3 COMPACTION

- A. Where subbase courses must be moisture-conditioned before compaction, uniformly apply water to the surface. Prevent free water from appearing on the surface during or subsequent to compaction operations.
- B. Compact all portions of each layer to a density not less than 95 percent of the maximum density.
- C. Final tolerances for the top surface of the subbase course requires that the surface does not extend more than 1/4 inch above nor more than 1/4 inch below the specified grade at any location.

3.4 TRAFFIC ON SUBBASE

- A. The movement of vehicular traffic over the final surface of the subbase may be permitted at locations designated by, and under such restrictions as ordered by the Engineer, provided such movements take place prior to the final finishing of this course to the specified tolerance. The movement of construction equipment on this course may be permitted, at locations designated by and under such restrictions as ordered by the Engineer at locations where permission is granted for such movement, the temporary surface of the course upon which the construction traffic is running, shall be placed and maintained for at least 2 inches above the final surface of this course. Just prior to paving, and after all construction traffic not required for the removal has ceased, remove the 2 inch protective layer, prepare the exposed surface of the course, and compact to the specified tolerance.
- B. Should the subbase become mixed with the subgrade or any other material, through any cause whatsoever, remove such mixture and replace it with the specified subbase material.

3.5 FIELD QUALITY CONTROL

- A. Notify the Engineer at least 1 working day in advance of all phases of subbase installation.
- B. Comply with the requirements of this Section for in-place relative density testing.
 - 1. In-place relative density:
 - a. Method: AASHTO T238, Nuclear Method.
 - b. Number of Tests: 1 per specified interval.
 - c. Acceptance Criteria: Plus/minus 2 percent of specified percent compactions.
 - 2. Compaction tests shall be provided for every 1000 square yard of subbase placement. A minimum of 3 for each lift is required.
 - 3. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions.
 - 4. Acceptance Criteria: The sole criterion for acceptability of in-place subbase shall be in situ dry density. Minimum dry density for all subbase shall be 95 percent of the maximum dry density. If a test fails to qualify, the fill shall be further compacted and re-tested. Subsequent test failures shall be followed by removal and replacement of the material.

END OF SECTION

SECTION 321313 – CONCRETE PAVING

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes provisions for the placement of Portland cement concrete pavement.
- B. Place Portland cement concrete pavement in conformance with the lines, grades, thicknesses and typical sections shown or detailed on the Drawings.

1.2 REFERENCES

- A. Applicable State DOT Standard Specifications.
- B. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Testing Agency Qualifications:
- D. Material Test Reports: Indicating compliance with requirements.

1.4 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. The latest edition of the following standards, as referenced herein shall be applicable:
 - a. Applicable State DOT Standard Specifications.
 - b. American Society of Testing and Materials (ASTM).
 - c. American Concrete Institute (ACI).
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

- D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests.

1.5 PROJECT REQUIREMENTS

- A. Coordinate the placement of Portland cement concrete pavement with the completion of underground work by other trades.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Conform with Section "Subbase Courses" for subbase course.
- B. Concrete:
 - 1. 28-Day Compressive Strength: 4000 psi (minimum).
 - 2. Water to Cement Ratio: 0.45 (maximum)
 - 3. Air Entrainment: 4 to 8 percent.
 - 4. Slump: 1 to 3 inches.
- C. Formwork:
 - 1. Do not use earthcuts for vertical surfaces.
 - 2. All forms shall be built mortar tight and of materials sufficient in strength to hold concrete without bulging between supports. Forms shall be maintained to eliminate the formation of joints due to shrinkage of the forms. Concrete, misshapen by bulges or deformations caused by inadequate forms, shall be removed or corrected as ordered by the Engineer. All replacements or corrections shall be made at the Contractor's expense.
 - 3. All surfaces of wooden forms that will be in contact with exposed concrete shall be thoroughly treated with an approved lacquer in the procedure recommended by the manufacturer. Forms so treated shall be protected from being damaged or dirtied prior to placing of the concrete.
 - 4. Metal forms shall be treated with an approved form lacquer or may be treated with an approved form oil. The metal used for forms shall be of sufficient thickness to remain true to shape. All bolt and rivet heads shall be designed to hold the forms rigidly together and to allow removal, without injury to the concrete. Metal forms which do not have smooth surfaces, correct alignment and clean surfaces shall not be used.
- D. Steel Reinforcement
 - 1. Reinforcing Bars: ASTM A615, Grade 60
 - 2. Plain Steel Welded Wire Reinforcement: ASTM A185, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Joint and Curb Ties:
 - 1. Conform to the Details shown on the Drawings.

- F. Curing Compound
 - 1. Uncolored Concrete: Resin-base, white pigmented compound conforming to ASTM C309, Type 2.
- G. Joint Sealant:
 - 1. An elastic, one component, self-leveling, premium grade polyurethane sealant conforming to ASTM C920, Type 5, Grade P, Class 25, Use T₁.
 - 2. Manufactured by W.R. Meadows, Sika Corporation, Euclid Chemical Co., or approved equal.
 - 3. Color: Selected by Engineer. Submit standard manufacturers color chart.
- H. Joint Bond Breaker:
 - 1. 3/8-inch diameter polyethylene foam rod.
- I. Premolded Joint Filler:
 - 1. ASTM D1751 or ASTM D1752.

PART 3 – EXECUTION

3.1 GENERAL

- A. Concrete pavement shall not be applied when the air temperature is below 40 DegF or above 95 DegF unless otherwise directed or when weather conditions would prevent proper construction.

3.2 PREPARATION

- A. The subbase shall be placed and compacted true to line and grade as shown on the Drawings and conforming to Section “Subbase Courses.”
- B. Proof roll prepared subbase surface with a 10-ton static steel wheel roller to check for unstable or otherwise unsuitable areas as determined by the Engineer. Replace and recompact all unsatisfactory areas, as approved by the Engineer, prior to commencement of paving operations.
- C. Notify the Engineer 48 hours prior to commencing placement of concrete.
- D. Moisten base to minimize absorption of water from fresh concrete.

3.3 CONCRETE PLACEMENT

- A. All foreign matter of any kind shall be removed from the interior of forms before placement of the concrete. Temporary struts or braces within the forms shall be removed when concrete has reached an elevation rendering their further service unnecessary.
- B. Concrete shall be rejected which does not reach its final position in the forms within 60 minutes after water is first added to the mix.
- C. Concrete shall be placed so as to avoid segregation of the materials and displacement of the reinforcement. Long troughs, chutes and pipes for placing or conveying concrete may be used only on written authorization of the Engineer, and he may also order their discontinuance, if inferior quality of concrete is produced.
- D. Dropping the concrete a distance of more than 3 feet or depositing a large quantity at any point and running or working it along the forms will not be permitted.

- E. Concrete shall be compacted by continuous working with a suitable tool in a manner acceptable to the Engineer. All thin section work shall be thoroughly worked with a steel slicing rod.
- F. Concrete shall be placed in horizontal layers not more than 12 inches thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding batch has taken its initial set to prevent injury to the concrete and avoid cold joints between the batches. Each layer shall be compacted so as to avoid the formation of a joint with a preceding layer, which has not taken initial set.
- G. Construction joints shall be placed only where shown on the plans or as permitted by the Engineer.
- H. Concrete shall be thoroughly compacted during and immediately after depositing by vibrating the concrete internally by means of mechanical vibrating equipment.
 - 1. Lateral transport of the concrete by means of vibrating equipment will not be allowed.

3.4 FINISH

- A. After placement the concrete shall be smoothed with an approved mechanical or hand screed.
- B. Edge rounding shall not exceed 1/4 inch and surface irregularities shall not exceed 1/8 inch in 10 feet.
- C. Texturing:
 - 1. Immediately after smoothing operations have been completed and prior to application of curing compound, the surface of the concrete shall be textured with a set of spring steel tines in a direction perpendicular to the center line of pavement.
 - 2. The individual tines shall be rectangular in shape, 3/16 inch wide, 1/32 inch thick, and approximately 6 inches long. The center to center spacing of the tines shall be approximately 3/4 inch. They shall be capable of producing striations generally not less than 3/16 inch deep in the plastic concrete in the one pass.
 - 3. More than one pass over the same area will not be permitted unless the surface has first been refinished. The capability of the tines to provide an acceptable texture shall be demonstrated to the Engineer prior to approval for use.
 - 4. The tine head may be operated by hand or mechanically. In either case, concrete texturing shall take place with the longitudinal axis of the tines as nearly at an angle of 45 degrees to the concrete surface as is practicable to eliminate the dragging of mortar by the tines. The tines shall be kept free of hardened concrete particles.

3.5 REMOVAL OF FORMWORK

- A. Forms will remain in place at least 12 hours after the placing of the concrete. This duration may be lengthened if, in the opinion of the Engineer, conditions warrant.

3.6 JOINTS

- A. Longitudinal and transverse joints shall be constructed as indicated on the Plans and in accordance with these requirements. All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement. Joints shall not vary more than 1/4 inch from a true line or from their designated position. The surface across the joints shall be tested with a 10-foot straight edge as the joints are finished and any irregularities in excess of 1/8 inch shall be corrected before the concrete has hardened.

- B. Transverse joints shall be at right angles to the center line of the pavement and shall extend the full width of the panel. The transverse joints in succeeding lanes shall be placed in line with similar joints in the first lane.
- C. All joints shall be so prepared, finished, or cut to provide a groove of sufficient width and depth to receive and effectively retain joint- sealing material.
- D. When joints in concrete pavements are sawed, the joints shall be cut at the time and in the manner approved by the Engineer. The circular cutter shall be capable of cutting in a straight line, and shall produce a slot at least 5/16 inch wide. When shown on the Plans or required by the Specifications, the top portion of the slot or groove shall be widened by means of a second cut or by suitable and approved leveling to provide adequate space for joint sealers. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing. The joints shall be sawed at the required spacing consecutively in sequence of the concrete placement, unless otherwise approved by the Engineer.

3.7 SURFACE SEALANT

- A. Apply surface sealant in accordance with manufacturer' instructions.

3.8 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 DegF and below and when 80 DegF and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C31/C31M.
 - a. Cast and laboratory cure three sets of two standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days. The remaining two cylinder will be held in reserve. If the results of the 28 day tests indicate low strength concrete, the engineer will direct the contractor and laboratory to test the remaining two cylinders at a time directed by the engineer.
 7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

8. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

END OF SECTION

SECTION 321813 – SYNTHETIC TURF PLAYING FIELD SYSTEM

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, equipment, and materials, and do work necessary to construct a synthetic turf field replacement, as indicated on the Drawings and as specified. Work shall include but shall not be limited to:
1. Synthetic surface including all inlays and/or painted lines/markings and related finish work.
 2. Installation/replacement of perimeter anchor systems and subsurface drainage system including stone base and topping stone.

1.2 REFERENCES

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.
1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. T 89 - Determining the Liquid Limit of Soils.
 - b. T 90 - Determining the Plastic Limit and Plasticity Index of Soils.
 2. Occupational Safety and Health Administration (OSHA).
 3. Department of Transportation Standard Specifications
 4. American Society for Testing and Materials (ASTM):
 - a. D 395 - Rubber Property – Compression Test.
 - b. D 418 - Pile Yarn Floor Covering Construction.
 - c. D 2256 - Breaking Load (Strength) and Elongation of Yarn by the Single-Strand Method.
 - d. D 3776 - Mass Per Unit Area (Weight) of Woven Fabric.
 - e. D 3786 - Hydraulic Bursting Strength of Knitted Goods and Non-Woven Fabrics: Diaphragm Bursting Strength Tester Method.
 - f. D 4491 - Water Permeability of Geotextiles by Permittivity.
 - g. D 4533 - Trapezoid Tearing Strength of Geotextiles.
 - h. D 4632 - Breaking Load and Elongation of Geotextiles (Grab Method).
 - i. D 4833 - Index Puncture Resistance of Geotextiles, Geo-membranes, & Related Products.
 - j. F 355 - Shock Absorbing Properties of Playing Surface Systems and Materials.
 - k. F 405 - Corrugated Polyethylene (PE) Tubing and Fittings.
 - l. F 449 - Subsurface Installation for Agricultural Drainage or Water Table Control.
 - m. F 667 - 8, 10, 12 and 15-inch Corrugated Polyethylene Tubing and Fittings.

1.3 DEFINITIONS

- A. Subgrade: The undisturbed earth or the compacted soil layer immediately below proposed drainage fill or playing field materials.

1.4 SUBMITTALS

- A. Manufacturer's Product Data: Submit manufacturer's specifications and installation instructions for all products in the playing field system, including certifications and other data as may be required to show compliance with the Contract Documents. Included but not limited to the following; drainage

pipe material, geotextile fabric perimeter turf anchoring system, goal post system and foundation sleeve and stone base.

- B. Material Certifications: Manufacturer's or vendor's certified analysis for rubber and sand infill amendments.
- C. Material samples. Submit three samples each of the following:
 - 1. Gravel Materials – See Section 1.8, “Quality Control”.
- D. Synthetic Turf Material Samples and Test Reports:
 - 1. Synthetic Turf – Three samples, approximately 7" x 11".
 - 2. Rubber/Sand Mix with proper ratio or Rubber - three samples, approximately 8-ounces each.
 - 3. Submit to Owner for approval - quality assurance information as delineated in paragraphs 1.5 Quality Assurance below.
 - 4. Certified list of successful existing installations, including Owner representative and telephone number, attesting compliance with quality assurance information.
 - 5. Certified copies of independent (third-party) laboratory reports on ASTM tests as follows:
 - a. Pile Height, Face Weight & Total Fabric Weight - ASTM D418.
 - b. Primary & Secondary Backing Weights – ASTM D418.
 - c. Tuft Bind – ASTM D1335.
 - d. Grab Tear Strength – ASTM D1682.
 - e. Dynamic Cushion Test (G-max) - ASTM F-355, Procedure A (system).
 - 6. Seam – Sewn or glued per manufacturers’ recommendation.
 - a. 24 inches in length.
 - 7. Color: Submit sample of line markings for approval by Owner.
- E. Supplier List: Submit list of procured and contracted suppliers of all materials required for the Playing Field System.
- F. Shop Drawings :
 - 1. Sample Warranty.
 - 2. Seam layout of the field.
 - 3. Striping plan: Submit one for each field.
 - 4. Layout for Owner designated sports, showing any field lines, markings, boundaries and logos.
 - 5. Construction detail sketches, especially those that may deviate from the plans and specifications. Include but not limited to the following; perimeter turf anchor details, details at irrigation valves, valve boxes, other inserts or fixed features, etc.
- G. Manufacturer’s Review: Submit written statement, signed by Contractor and synthetic field surfacing installer stating that the Drawings and Specifications have been reviewed by qualified representatives of the materials manufacturer, and that they are in agreement that the materials and system to be used for synthetic field surfacing are proper and adequate for the applications shown.
- H. Statement of Supervision: Upon completion of the Work, Contractor to submit a written statement signed by the synthetic turf manufacturer stating that the field supervision by the manufacturer’s representative was sufficient to insure proper application of the complete system and materials, that the Work was installed in accordance with the Contract Documents, and that the installation is acceptable to the manufacturer.

1.5 QUALITY ASSURANCE

- A. The sports field contractor shall have previously installed at least six (6) artificial turf infill fields larger than 50,000 square feet in the last (3) years.
 - 1. The sports field contractor is responsible for the subgrade fine grading, installation of fabric, installation of field drainage system, installation of the perimeter nailing system and installation of the stone base.
- B. The synthetic field turf installation shall be performed by a firm and crew having completed at least six (6) fields in the last three (3) years on projects of similar size and type to this project. The firm shall have the approval of the synthetic field surfacing materials manufacturer. The synthetic field installation superintendent shall provide a list of the five (5) projects for which he was responsible.
- C. The Sports Field Contractor and the Synthetic Turf Manufacturer/Supplier must have been in business under the same ownership for at least three years, and shall have been installing similar sports fields for that entire period.
- D. Provide test results from certified laboratory certifying capability of aggregate base course (stone base) to meet permeability and stability requirements before construction.
- E. Lay test strip and establish compaction and density rates for each course with nuclear gauge before beginning permanent work.
- F. The turf manufacturer/supplier shall submit a list of all completed products, using the specified turf system. The list shall include references for at least five of the projects.
- G. The synthetic field surfacing manufacturer shall provide evidence indicating that the specified materials have been successfully utilized on work of similar scope to that shown and specified for this Project.

1.6 QUALITY CONTROL

- A. Prior to construction: Submit samples of each of the following materials to establish Baseline specification and ratios for the remainder of the testing process.
 - 1. Gravel Drainage Material: Provide a one-gallon sample of each gravel drainage source and for each type of gravel material to be used for testing. This could include:
 - a. Gravel trench drainage material.
 - b. Base Stone.
 - c. Topping Stone.
- B. During Construction: Submit samples of each of the following during mass production of gravel materials for performance testing and prior to shipping. All costs associated with materials testing shall be paid for by the Contractor.
 - 1. Earthwork Material Qualification and Testing:
 - a. If found necessary, submit the following test data for each potential borrow source.
 - 1) Particle Size Analysis:
 - a) Method: AASHTO D422.
 - b) Number of Tests: Three (3) per potential source.
 - c) Acceptance Criteria: Gradation within specified limits.
 - 2) Maximum Density Determination:
 - a) Method: Modified Proctor Test - ASTM D 1557.

- b) Number of Tests: Three (3) per potential source.
 - b. Re-establish gradation and maximum density of fill material if source is changed during construction.
 - 2. Earthwork/Compaction Testing:
 - a. All compaction testing shall be performed by as required in Section 312333 “Trenching and Backfilling”.
 - b. Compaction testing shall be performed to ascertain the compacted density of the fill and backfill materials in accordance with the following methods:
 - 1) In-place relative density:
 - a) Method: ASTM D-1556, Sand Cone Method.
 - b) ASTM D-2922, Nuclear Method.
 - 2) Number of Tests:
 - a) One (1) per 5,000 SF in each vertical lift.
 - c. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions.
 - d. Acceptance Criteria: The sole criterion for acceptability of in-place fill shall be in situ dry density. Minimum dry density for all fill or backfill shall be 95 percent of the maximum dry density as determined by the Modified Proctor Test (ASTM D-1557). If a test fails to qualify, the fill shall be further compacted and re-tested. Subsequent test failures shall be followed by removal, replacement of the material and retesting.
 - 3. Gravel Drainage/ Stone Base/Topping Stone Material:
 - a. A minimum of one-gallon sample for every 500 cubic yards of each material used shall be tested by the Playing Field Testing Agent for general compliance with the established Baseline specifications.
- C. Testing Agents:
 - 1. The Owner shall contract with, and pay for, an independent testing agent to certify and make recommendations regarding compaction, concrete, geotechnical and other items required by the Work. The Playing Field Contractor shall notify the Owner regarding timing, scheduling and use of these agents.
 - 2. Playing Field Testing Agent:
 - a. The Owner shall hire an independent Testing Agent to perform testing of the field system material components, as well as to certify the capability of the stone base course to meet permeability and stability requirements before construction. This Agent shall be A2LA accredited and insured.
 - b. Gravel Materials Test Reports: The Playing Field Testing Agent is to report/submit test results as they are known and simultaneously to the Playing Field Contractor, the Owner and its representatives.

1.7 DELIVERY, STORAGE AND HANDLING

- A. All materials shall be delivered and stored within the Contractor’s work limits or in an area approved by the Owner. Materials shall be inspected for damage immediately upon delivery.
- B. All material shall be stored in strict accordance with the manufacturer’s recommendations.
- C. Special care shall be exercised during delivery and storage to avoid damage to the products.
- D. Products that are damaged will be removed and replaced, unless the product can be repaired in an acceptable manner by the Contractor, at his expense.

- E. Packaged Materials:
 - 1. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.
- F. Drainage Gravel and Stone Base:
 - 1. Deliver tested and approved lots in clean, washed and covered trucks to eliminate contamination during transportation. Place directly on playing field. Do not stockpile on site.

1.8 COMPLETION AND ACCEPTANCE

- A. General: Field completion shall be separated into 2 phases, "Preliminary Completion" and "Substantial Completion."
- B. Preliminary Completion: Scheduled date for preliminary completion shall be at least 10 calendar days before Substantial Completion. Notify the Playing Field Designer/Engineer and Owner in writing, 3 days prior to scheduled date for observation for "Preliminary Completion." To be considered "Preliminarily Complete" the following items shall be provided:
 - 1. Stone base in place, compacted and to grade.
 - 2. Synthetic turf installed inclusive of infill materials, field markings and logos.
 - 3. Goal post sleeves installed.
- C. Substantial Completion: After "Preliminary Completion" observation, the Playing Field Designer/Engineer and Owner shall prepare and submit to the Contractor, a punch list of items to be completed to achieve "Substantial Completion". Contractor shall notify the Playing Field Designer/Engineer and Owner in writing, 5 days prior to a requested date for a site observation to meet "Substantial Completion." To be considered "Substantially Complete" or "Playable" the following items shall be provided:
 - 1. All "Preliminary Completion" punch list items are complete.
 - 2. Submit five (5) copies of written operating and maintenance instructions. Provide format and contents as directed by the Engineer.
 - 3. Submit (5) copies of all certified surveys performed during construction for Quality Control.
 - 4. Instruct the Team or Owner's personnel in the operation of the irrigation and other systems.
 - 5. Smooth, level playing surface level to grading tolerances.
 - 6. Written warranties/guarantees.
 - 7. Stockpiling or storage of required "attic stock" materials.
 - 8. Upon completion of the synthetic field surface, the contractor shall provide the owner with 2 hours of maintenance training that shall be recorded on a video tape and supplied to the Owner.

1.9 WARRANTY/GUARANTEE

- A. General: Warranties / Guarantees specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and are in addition to and run concurrent with other warranties/guarantees made by the Contractor under requirements of the Contract Documents.
- B. The following are inclusive of the term "Playing Field System" for provisions of the guarantee:
 - 1. Final grade tolerances to one-quarter inch in the length of 25' of finish grade in any direction.
 - 2. Synthetic turf product as specified and represented by the Turf manufacturer/vendor.
 - 3. Working functions of the drainage system.
 - 4. All materials and products specified.
 - 5. Topping Stone shall be guaranteed to have a percolation rate greater than 20 inches per hour.

- C. **Installer Guarantee:** Provide in writing a “Full System Guarantee” agreement. The President(s) of the synthetic turf manufacturer (if different) shall sign this document and it shall include the following:
1. All work executed under this section will be free from defects of material and workmanship for a period of eight (8) years from date of Substantial Completion.
 2. Any defects will be remedied on written notice at no additional cost to the Owner.
 3. Guarantee shall include removal and replacement of materials (parts and labor) as required to repair synthetic field surfacing at no cost to the Owner.
 4. The 8 year warranty shall not be prorated and be provided by third party non-cancelable insurance policy.
 5. At no time in the life of the Guarantee shall the G-Max exceed 175 at any one point on the field.
- D. **Statement of Supervision:** Upon completion of the Work, Contractor to submit a written statement signed by the synthetic turf manufacturer stating that the field supervision by the manufacturer’s representative was sufficient to insure proper application of the complete system and materials, that the Work was installed in accordance with the Contract Documents, and that the installation is acceptable to the manufacturer.
- E. **G-Max Testing:** The synthetic surface manufacturer shall retain a third party certified testing laboratory and shall perform G-Max testing during the first year of the life of the Guarantee.
1. Testing shall be performed at within 10' of mid center, at the goal locations for soccer and lacrosse, and at 10 yards inside the corners of the overlaid rectangle fields. This results in a total of 9 tests. The testing shall be performed between 90 and 120 days after substantial completion. (These tests are paid for by the Contractor).
 2. Testing shall consist of shock attenuation per ASTM F-355 procedure A.
 - a. G-Max shall not change more than 5% (five percent) at any one location per year over the life of the Guarantee.
 - 1) In cases where the results of the above testing exceed the specified values, the condition shall be corrected by the synthetic surface manufacturer. The synthetic surface manufacturer shall provide adequate information to confirm that the mitigation measures were effective.
 - b. At no time in the life of the Guarantee shall the G-Max exceed 175 at any one point on the field.
 3. Future testing shall be performed by a certified independent lab and paid for by the Owner.

1.10 SPARE PARTS/ATTIC STOCK

- A. **Stockpile Materials:** Provide the following additional materials. Rubber infill shall be stored as directed by the Owner. Synthetic Turf shall be rolled out and placed on site (loose laid) as directed by the Owner.

MATERIAL	QUANTITY
Rubber Infill	2 tons
Green Synthetic Turf	1,050 SF (15'x70')
Navy Blue Synthetic Turf	1,050 SF (15'x70')
Carolina Blue Synthetic Turf	450 SF (15'x30')

PART 2 – PRODUCTS

2.1 PERIMETER TURF ANCHOR/NAILER

- A. The perimeter turf anchor/nailer shall be located at the field perimeter or turf edges and shall be as per drawings, or approved equal.

2.2 STONE BASE and TOPPING STONE

- A. The stone base shall conform to the turf vendor’s standard specifications subject to the engineer’s approval and meet the following gradation:

SIEVE SIZE	PERCENT PASSING BY WEIGHT
1-1/2"	100
1"	95-100
1/2"	25 – 80
1/4"	0-10
No. 8	0-5

- B. The topping stone must conform to the turf vendor’s standard specifications, is subject to the Engineer’s approval, and meets the following gradation:

SIEVE SIZE	PERCENT PASSING BY WEIGHT
1/2"	100
3/8"	90 – 100
1/4"	75 – 100
No. 8	35 – 75
No. 16	10 – 55
No. 60	0 – 15
No. 200 (75mm)	0 – 4

2.3 SYNTHETIC INFILL TURF PRODUCT

- A. Turf Product Specifications:
 - 1. A UV stable, slit-film polyethylene fiber system.
 - 2. Finish pile height: 2.25” min. inches.
 - 3. Permeability: 15” per hr. min.
 - 4. G-max at install: 100-125 max.
 - 5. G-max over life of field: 175 max.

- B. Acceptable Turf Products:
 - 1. Astroturf – Rhino SF.
 - 2. Shaw Sports Turf – Momentum 51.
 - 3. FieldTurf – Classic FTHD1.
 - 4. Sprinturf – Ultrablade 44

- C. Appearance/Feel:
 1. The finished playing surface shall appear as mowed grass with no irregularities and shall afford excellent traction for conventional athletic shoes of all types.
 2. The finished surface shall resist abrasion and cutting from normal use.

D. Infill Materials

1. Rubber shall be dust toxics & metal free. Particle sizes shall be consistent in size and shape, between .25 and 3 mm.
2. Sand shall meet the following gradation:

SIEVE SIZE	% RETAINED
2 mm	0
.5 mm	20-30
.25 mm	40-50
.15 mm	30-40
.05 mm	5-10

3. Infill material shall be as recommended by the turf system MFR. The sand component shall be as recommended by the turf system MFR.
4. The overall sand/rubber infill mix depth shall be at least 75% of the overall pile height of the installed synthetic turf system.

E. Glued seams

1. Adhesives for bonding tufted synthetic turf shall be as recommended by the synthetic turf manufacturer. Adhesives shall be one-part moisture cured polyurethane.

F. Sewn Seams

1. Cord for sewing seam turf shall be as recommended by the synthetic turf manufacturer.

2.4 SYNTHETIC INFILL TURF MAINTENANCE EQUIPMENT

- A. Provide (one) turf sweeping unit including all necessary tools and equipment to properly maintain the synthetic turf system including the alternate systems:
 1. Supply a 6' wide field sweeper with magnet, which shall include a towing mechanism compatible with a field utility vehicle. The field sweeper shall be the LitterKat 760 sweeper, or equivalent.
 2. Supply one turf groomer. Turf groomer shall be 6' wide and be the Sportsturf Groomer 720-SDE by Greens Groom or the G7 Groomer by Go Groomer Go, or equal.

PART 3 – EXECUTION

3.1 EXAMINATION AND PROTECTION

- A. Verification of Conditions: Examine areas and conditions under which all work of this Section is being performed. Do not proceed with any work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of all areas and conditions.

- B. Protection of Work: Protect all on-going work, so as not to delay work due to weather or project related construction. This includes but is not limited to the use of tarps, geotextile, plywood and other protective measures.
- C. Protection of Persons and Property: Provide all necessary measures to protect workmen and passersby. Barricade open excavations occurring as part of the work, as required by municipal or other authorities having jurisdiction.
 - 1. Protect adjacent construction throughout the entire operation. Protect newly graded areas from destruction by weather or runoff. Protect structures, utilities, pavements, and other improvements from damage caused by settlement, lateral movement, undermining and washout.
- D. Unanticipated Conditions: Notify the Engineer immediately upon finding evidence of previous structures, filled materials that penetrate below designated excavation levels, or other conditions which are not shown or which cannot be reasonably assumed from existing surveys and geotechnical reports. Secure the Engineer's instruction before proceeding with further work in such areas.
- E. Installation of synthetic field surfacing shall be done only after excavation and construction work which might injure it has been completed. Damage caused during construction shall be repaired before acceptance.
- F. The Contractor shall coordinate the installation of the synthetic field surface and the surrounding surfaces for optimum interface at all edges.

3.2 EARTHWORK EXECUTION / SUBGRADE

- A. Preparation:
 - 1. Establish required lines, levels, contours and datum. Sports Field Contractor shall coordinate and ensure that the final grade of various materials such as the Stone Base, turf infill, etc., will result in the final field grades shown on the Contract Drawings when the complete system is installed.
 - 2. Maintain benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to the Owner.
 - 3. Establish location and extent of utilities before commencement of grading operations.
 - 4. Surface Water Control:
 - a. All earthwork operations shall be conducted in a manner to prevent surface water from infiltrating into the subgrade and base. Drainage is to be maintained in all parts of the site to drain surface water without ponding at all times. The Contractor, at his own expense, shall undercut soils saturated by ponding and backfill per this Section at the direction of the Engineer.
- B. Grading:
 - 1. The finished grade lines are shown on the contract drawings. Upon completion of this work, all debris shall be cleaned out and removed from the premises.
 - 2. Grade Verification: Upon completion of the topping stone and the finished synthetic turf surface, the Contractor shall provide drawings, completed by a licensed surveyor, sharing the elevations at each of the phases. Elevations shall be taken on a 25' grid across the entire field area. Tenth of a foot contours shall be shown on the submitted survey.
 - 3. All cutting, filling, backfilling and grading necessary shall be done to bring the area to the following grade levels:
 - a. The final elevation of the topping stone and finish synthetic turf surface shall be within one-quarter inch on a 25 foot by 25 foot grid of the finished grades indicated on the

Contract Drawings. Laser controlled or indicated equipment shall be used for this part of the work.

- b. All surfaces shall be graded to drain to drainage structures with no ponding. Grading tolerances given above do not relieve the Contractor from this requirement.
4. Sufficient grading must be done during the progress of the work so that the entire site shall be well drained and free from water pockets.

3.3 TURF PERIMETER NAILER/ANCHOR

- A. Install approved anchoring system at entire perimeter/edges of turf installation.
- B. Install anchoring/nailing “collar” around other in place or installed items (quick coupler boxes, power/communication boxes, etc.), as appropriate to installation sequencing.

3.4 INSTALLATION OF STONE BASE/TOPPING STONE

- A. Install tested and approved material at a uniform depth as indicated on drawings.
- B. Placement of the stone base shall proceed from a stable area next to the geotextile fabric and systematically worked outward onto the field area.
 1. The cover material shall be pushed forward and not dumped onto the liner.
 2. Laser operated equipment shall be utilized.
 3. All equipment used in spreading or traveling on the cover layer shall exert low ground pressures and shall be approved by the manufacturer and Engineer.
 4. During placement and spreading,
 - a. A minimum depth of 6 inches of granular material shall be maintained at all times between the fabric and wheels of trucks or spreading equipment.
 - b. Dozer blades, etc. shall not make direct contact with the fabric. If tears occur in the fabric during the spreading operation, the granular material shall be cleared from the fabric and the damaged area repaired as previously described.
 - c. All equipment traveling on the cover layer shall avoid making sharp turns, quick stops or quick starts.
 - d. Care shall be taken to not disturb, displace or damage the geotextile fabric or the drainage system.
- C. Placement of the Topping Stone: This stone layer shall be placed over the stone base at an approximate depth of one-half inch to produce a level/smooth surface prior to the placement of the synthetic turf.
- D. A permeability test shall be performed on the topping stone at 2 locations along the North side of the field at approximately 3’ from the curb line. The permeability tests shall utilize a dual ring infiltrometer in accordance with ASTM test method and the test results shall be greater than 20” per hour.
- E. Finish grade for Topping Stone shall be verified using laser operated survey instrument with a tolerance of +/- one-quarter inch over 25 feet in any direction.
 1. A survey of the finished spot grades is to be developed by a State licensed surveyor over the entire surface in a 25 foot grid. The survey shall be certified (signed) and submitted to the Owner and its representatives for approval prior to installing the synthetic turf.

3.5 INSTALLATION OF SYNTHETIC TURF

- A. Synthetic turf shall be installed by crews employed by the Synthetic Turf manufacturer, in strict accordance with manufacturer's recommendations and instructions including but not limited to, fabric, adhesives, seaming and abutting or attaching to adjacent materials.
- B. Field markings and lining of synthetic field surfacing shall be laid out as shown on the drawings and as approved by the Owner with Contractor submitted drawings.
- C. Turf panel seams shall be sewn with high strength thread using a double loop stitch or glued with an adhesive as recommended by the synthetic turf manufacturer and installed per manufacturer's instructions. All seams shall be flat, tight and permanent with no separation or fraying.
- D. All inlaid lines shall be backed using seaming tape with a width of 12 inches.
- E. Anchor turf edges at perimeter as shown on drawings and as recommended per synthetic turf manufacturer.
- F. At the end of each day, remove all scraps and other debris created by the synthetic turf installation from the playing field area.
- G. Infill materials shall be applied at a uniform depth and at an ultimate finish grade tolerance of ¼ inch at any point over the entire playing field area.
- H. Fiber shall not be buried or trapped below infill material when complete.
- I. Anchor turf edges at field curb and at field perimeter as shown on drawings.
- J. The finish turf surface shall have a permeability test performed on 5 locations on the field.
- K. The permeability tests shall utilize a dual ring infiltrometer in accordance with ASTM test method. All test results on the finish infilled synthetic turf surface must be greater than 6 inches per hour.

3.6 FIELD MARKINGS

- A. The field lines shall be tufted or inlaid per Owner designated sports. The final field markings shall meet the NFHSA standards as shown on the striping plan drawings.

3.7 CLEAN UP

- A. Remove all surplus excavated material not required for filling and backfilling, trash, and debris and dispose of it properly off of the Owner's property at Contractor's expense.

END OF SECTION

SECTION 329113 – SOIL PREPARATION

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes provisions for the placement of topsoil in conformance with the lines, grades and thicknesses as shown on the Drawings and as herein specified.
 - B. Minimum thickness is 6 inches, for all areas disturbed during construction and not receiving other surface treatment.
 - C. The Contractor shall furnish all materials and perform all work in accordance with these specifications, drawings, and instructions provided by the Owner.
-

1.2 SUBMITTALS

- A. Samples: Furnish earth materials to the testing laboratory for analysis and report, as directed by the Engineer or as outlined in the specifications.
- B. Quality Control Submittals:
 - 1. Test Reports: The testing laboratory shall submit written reports of all tests, investigations, and recommendations to the Contractor and the Engineer. Indicate quantities of materials necessary to bring topsoil into compliance with textural/gradation requirements. Indicate quantity of lime and quantity and analysis of fertilizer.

1.3 REFERENCES

- A. Comply with the latest edition of the following standards:
 - 1. Applicable State DOT Standard Specifications
 - 2. “Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).”
 - 3. ASTM International (ASTM):
 - a. C33, Standard Specification for Concrete Aggregates.
 - b. C602, Standard Specification for Agricultural Liming Materials
 - 4. U.S. Bureau of Reclamation (USBR):
 - a. 514.4.4, Reclamation Instructions, Series 510—Land Classification Techniques and Standards, Part 514—Laboratory Procedures, Chapter 4—Particle-Size Analyses.
 - b. 14.8.7, Reclamation Instructions, Series 510—Land Classification Techniques and Standards, Part 514—Laboratory Procedures, Chapter 8—Soil Chemical Tests.

1.4 QUALITY ASSURANCE

- A. Provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications.

1.5 PROJECT CONDITIONS

- A. Coordinate the placement of topsoil with the completion of all underground work including that of the other trades.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Topsoil: Natural, friable, fertile, fine loamy soil possessing the characteristics of representative topsoils in the vicinity which produces a heavy growth; free from subsoil, objectionable weeds, litter, sods, stiff clay, stones larger than 1 inch in diameter, stumps, roots, trash, toxic substances, or any other material which may be harmful to plant growth or hinder planting operations. Contractor is to verify amount stockpiled and supply any additional as needed:
1. Topsoil shall contain not less than 6% nor more than 20% organic matter as determined by the wet combustion method (chronic acid reduction); topsoil shall have a pH value of not less than 5.5 nor more than 7.0;
 2. Topsoil shall meet the following mechanical analysis:

SIZE OF SCREEN	% OF SOIL RETAINED	% OF SOIL PASSING
1"	0	100
1/4	3	97
No. 100	40-60	40-60

3. Imported topsoil in which more than 60% of the material passing a No. 100 sieve shall be rejected. All percentages are to be based on the dry weight of the samples.
4. Laboratory tests of the topsoil shall be performed by a certified testing laboratory, and shall perform tests for the following:
 - a. Sieve particle size analysis and gradient of mineral content.
 - b. Chemical analysis of the following:
 - 1) pH and buffer pH.
 - 2) Percent of organic content.
 - 3) Nutrient levels of phosphorus, potassium magnesium, manganese, iron, zinc and calcium.
 - 4) Soluble salt.
 - 5) Cation exchange capacity (CEC).
 - c. Recommended fertilizer and rate of application for low and medium level nutrient soils.

2.2 MATERIAL ACCEPTANCE

- A. Topsoil may be acquired from approved sites that are designated on the Drawings. If no sites are designated, material proposed for use as topsoil must be stockpiled, sampled, and tested prior to use.
- B. Topsoil containing foreign material may be rejected on the basis of visual examination by the Engineer, prior to testing.
- C. Acceptance of topsoil shall be based upon test results. Tested topsoil must be approved in writing by the Engineer before any material is used.

2.3 SOIL AMENDMENT

- A. Textural Amendments: Amend as necessary to conform to required composition by incorporating sand, peat, manure, or sawdust.

- B. Fertilizer: Shall be delivered to the site, mixed as specified, in the original unopened standard size bags showing weight, analysis and name of manufacturer. Store fertilizer in a weatherproof place and in such a manner that it shall be kept dry and its effectiveness shall not be impaired.
 - 1. Percentages of nitrogen, phosphorus and potash shall be based on laboratory test recommendations. For the purpose of bidding, assume 10% nitrogen, 6% phosphorus and 4% potash by weight. At least 50% of the total nitrogen shall contain no less than 3% water-insoluble nitrogen. At least 60% of the nitrogen content shall be derived from super-phosphate containing not less than 18% phosphoric acid or bone meal containing 25% to 30% phosphoric acid and 2% to 3% nitrogen. Potash shall be derived from muriate of potash containing 55% to 60% potash.
 - 2. Grass or sodded areas shall have fertilizer applied according to soil text report or as specified on the drawings.
- C. Organic Matter: Leaf matter and yard waste composted sufficiently to break down all woody fibers, seeds, and leaf structures, and free of toxic and non-organic matter. Organic matter shall be commercially prepared compost. Coarse sand shall be clean, sharp, natural sands free of limestone, shale and slate particles, ASTM C33 fine aggregate with a Fines Modulus Index of 2.75 or greater.
- D. Lime: Shall be ground palletized, or pulverized lime manufactured to meet agricultural standards and contain a maximum of 60% oxide.

PART 3 – EXECUTION

3.1 STOCKPILING

- A. Stockpile topsoil from on-site sources or provide from off-site sources and stockpile, if on-site quantities are deficient.
- B. Stockpiles are to contain not less than 200 cubic yards or the minimum required for the project.
- C. Stockpiles are to have a maximum height of 10 feet and be trimmed to uniform surfaces and slopes.
- D. The sites of all stockpiles and adjacent areas, which have been disturbed are to be graded and put into an acceptable condition by seeding, as directed by the Engineer.

3.2 PREPARATION

- A. Preparation - Disk, drag, harrow or hand rake subgrade to a depth of 3 inches to provide bond for topsoil. Topsoil, which must be transported across finished walks, shall be delivered in such a manner that no damage will be done to the walks. The Contractor shall be responsible for the repair of such damage.
- B. Before placing topsoil, rake subsoil surface clear of stones larger than 1.5 inches, debris, and roots. Compact topsoil to form a layer with minimum depth of 4 inches in lawn areas and 12 inches in shrub beds. Topsoil shall be placed so that after final settlement there will be good drainage (and conforming to elevations shown on drawings). Contractor is to maintain surfaces and place any additional topsoil necessary to replace that which may have eroded before acceptance.

- C. Locations containing unsuitable subsoil shall be treated in one of the following manners:
 - 1. Where unsuitability within the construction site is deemed by the Owner to be due to excessive compaction caused by heavy equipment or by the presence of boards, mortar, concrete or other construction materials in subgrade, and where the natural subsoil is other than A.A.S.H.T.O. classification of A6 or 7, the Contractor shall loosen such areas with spikes, discs, or other means to loosen the soil to a condition acceptable by the Owner. The Contractor shall also remove all debris and objectionable material. Soil should be loosened to a minimal depth of 12 inches with additional loosening as required to obtain adequate drainage. Contractor may introduce peat moss, sand, or organic matter into the subsoil to obtain adequate drainage should he so desire. All such remedial measures shall be considered as incidental to the work and no extra payment shall be made for this part of the work; and
 - 2. Where subgrade is deemed by the Owner to be unsuitable because the natural subsoil falls into an AASHTO classification of A6 or 7 and contains moisture in excess of 30%, then such a condition shall be rendered suitable by installation of a subdrainage system or by other means described elsewhere in these specifications. Where such conditions have not been known or revealed prior to planting time and where they have not been recognized in the preparation of drawings and specifications, then the Owner shall issue a change order to install the proper remedial measures, all of which shall be in addition to the contract sum.

3.3 TOPSOIL PLACEMENT

- A. Do not place topsoil when subsoil or topsoil is frozen, excessively wet, or otherwise detrimental to the Work.
- B. Mix soil amendments, lime, and fertilizer with topsoil before placement or spread on topsoil surface and mix thoroughly into entire depth of topsoil before planting or seeding. Delay mixing of fertilizer if planting or seeding will not occur within 3 days.
- C. Place 1/2 of total depth of topsoil and work into subgrade soil to create a transition layer. Place remainder of topsoil to depth after compacting to 75% where seeding and planting are scheduled.
- D. Uniformly distribute to within 1/2 inch of final grades. Fine grade topsoil eliminating rough or low areas and maintaining levels, profiles, and contours of subgrade to ensure positive drainage.
- E. Remove stones exceeding 1 inch, roots, sticks, debris, and foreign matter during and after topsoil placement.
- F. Remove surplus subsoil and topsoil from Site. Grade stockpile area as necessary and place in condition acceptable for planting or seeding.

3.4 CLEANING

- A. Remove all surplus subsoil and topsoil from project site.
- B. Leave the site in clean, satisfactory condition ready to receive subsequent operations.

END OF SECTION

SECTION 329200 – TURF AND GRASSES

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the preparation of ground surfaces, fertilization of applicable areas, seeding, mulching of applicable surface areas, and maintenance of turf areas until such time as project is accepted by Owner. Applicable areas shall include those identified on the Contract Drawings.
 - B. Seed shall be sown from April 1 to June 15, or from August 15 to October 15 of given calendar year, unless otherwise approved by Owner.
-

1.2 SUBMITTALS

- A. Quality Control Submittals:
 - 1. Certification:
 - a. Submit manufacturers or vendor's certified analysis for soil amendments and fertilizer materials.
 - b. Submit vendor's certified analysis for each grass seed mixture required, stating botanical and common name, percentages by weight, percentages by purity, germination, and weed seed.
 - B. Maintenance Instructions: Submit instructions recommending procedures to be implemented for maintenance of landscaped work for one (1) full year. Submit prior to expiration of Contractor's maintenance period.
 - C. Submit description of planned mulching techniques and corresponding manufacturer's installation recommendations for approval by Owner.

1.3 QUALITY ASSURANCE

- A. All turf and grasses work shall be performed by one Contractor, with proven expertise in this type of construction.
- B. Package standard products with the manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.
- C. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of materials with the specifications.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials in containers, showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored on site.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Fertilizer:

1. Commercial fertilizer (5-10-5) inorganic, or organic, containing not less than five (5) percent nitrogen, ten (10) percent available phosphoric acid, and five (5) percent water soluble potash.
2. If, as an alternative, the Contractor wishes to substitute for commercial fertilizer 5-10-5, another commercial fertilizer with a 1-2-1 ratio, such as 10-20-10 or 6-12-6, they may do so with the approval of the Engineer and the rate of fertilizer to be used shall be whatever amount is required to furnish the same amount of nitrogen as would be supplied by the 5-10-5.

B. Seed:

1. Seed shall be fresh, clean, new-crop seed mixed in the proportions specified for species and variety, conforming to Federal and State Standards.
2. Weed seed content shall not exceed 0.25%.

C. Mulch:

1. Provide and install a mulch adequate to protect the seeding during its growing period. It shall be the responsibility of the Contractor to determine the appropriate mulching techniques for the particular site conditions and acquire approval of the same from the Engineer.
2. Clean straw for gentle slopes, consisting of stalks of oats, wheat, rye, or other approved crops which are free of noxious weed seeds. Weight shall be based on a fifteen (15) percent moisture content.
3. Mulching blanket for steep slopes and drainage swales: “Curlex Blanket” by American Excelsior, “Ero-Mat” by Contech Construction Products, Inc, or approved equal.
4. Bonded fiber matrix for mulching in areas where slopes are 1.5H:1V or greater, or cut or fill slopes 20 feet (6m) or more in height. Product shall be EcoAegis as manufactured by Canfor, or approved equal meeting U.S. DOT Standard Specification FP-96, Section 713.05(h)
 - a. Package Weight: 50 pound (18.6kg) bags.
 - b. Moisture Content: 12 +/- 3 percent by weight.
 - c. Minimum Water Holding Capacity: Approximately 10 times dry weight.
 - d. Composition:
 - 1) Refined Softwood Fiber: (90% by weight).
 - 2) Blended Hydrocolloid-based Binder: (9% by weight).
 - 3) Mineral Activator: (1% by weight).
 - e. Color: Natural – No Dye Products.

D. Water: Clean and potable.

2.2 ACCESSORIES

A. Soil Amendments: Soil amendments are not to be made without review and authorization by the Engineer.

1. Lime: Natural limestone containing not less than 85% of total carbonates, ground so that not less than 90% passes a 10-mesh sieve and not less than 50% passes a 100-mesh sieve.
2. Aluminum Sulfate: Commercial grade.
3. Peat Humus: FS Q-P-166 and with texture and pH range suitable for intended use.
4. Bonemeal: Commercial, raw, finely ground; 4% nitrogen and 20% phosphoric acid.
5. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.

6. Sand: Clean, washed sand, free of toxic materials.
7. Perlite: Conforming to National Bureau of Standards PS 23.
8. Vermiculite: Horticultural grade, free of toxic substances.
9. Sawdust: Rotted sawdust, free of chips, stones, sticks, soil, or toxic substances and with 7.5 pounds (2.8 kg) nitrogen uniformly mixed into each cubic yard of sawdust.
10. Manure: Well rotted, unleached stable or cattle manure containing not more than 25% by volume of straw, sawdust, or other bedding materials and containing no chemicals or ingredients harmful to plants.
11. Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources and containing available plant nutrients.
12. Composted Organic Material: Shall have a minimum organic matter content of 60 percent, as determined by ASTM D-2974, and screened to ¾-inch (1.9 cm).

PART 3 – EXECUTION

3.1 PREPARATION OF TOPSOIL

- A. Clean topsoil of roots, plants, stones, clay lumps and other extraneous materials harmful or toxic to plant growth.
- B. Mix fertilizer into top 2 inches (5 cm) of topsoil at a rate of 10 pounds (3.7 kg) per 1,000 square feet (92.9 m²).
- C. Mix approved soil amendments into top 2 inches (5cm) of topsoil at necessary rates.
- D. Water dry topsoil to depth of 4 inches (10cm) at least 48 hours prior to seeding to obtain a loose friable seed bed.

3.2 PREPARATION OF UNCHANGED GRADES

- A. Where lawns are to be planted in areas not altered or disturbed by excavating, grading, or stripping, prepare soil for seeding as follows:
 1. Till to a depth of not less than 6 inches (15cm).
 2. Apply soil amendments and initial fertilizers as specified.
 3. Remove high areas and fill in depressions.
 4. Till soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots, and other extraneous matter.
 - a. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such materials off the site; do not turn over into soil being prepared for lawns.
 - b. Apply specified commercial fertilizer at rates specified and thoroughly mixed into upper 2 inches (5 cm) of topsoil. Delay application of fertilizer, if lawn planting will not follow within one week.

3.3 SEEDING

- A. Apply seed only when wind velocities are less than five (5) miles per hour (9km/hr).
- B. Sow half the seed with mechanical seeder.
- C. Sow remaining half of the seed at right angles to the direction of the first seeding pattern, using the same method.

- D. Apply seed at the rate of 4 pounds (1.5 kg) per 1,000 square feet (92.9 sq. meters) of disturbed area.
- E. Cover seed to a depth of 1/8-inch (3mm) by raking, harrowing, or cultipacking.
- F. Roll seeded area with roller weighing no more than 150 pounds per foot of roller width.
- G. Water seeded areas to a depth of four (4) inches (10cm) as required during the maintenance period.

3.4 MULCHING

- A. Spread straw uniformly over seeded area with 75% ground coverage and at least 1-1/2 inches loose depth.
 - 1. If, in the opinion of the Owner, wind will disrupt the mulching, apply asphalt emulsion at a rate of 10 gallons (37.81) per 1,000 square feet (92.9 m²).
- B. Place mulching blanket in accordance with submitted manufacturer's recommendations.
- C. Place bonded fiber matrix mulch material, EcoAegis, at a rate of 3,500 to 4,100 pounds per acre, based on manufacturer's recommendations.

3.5 PROTECTION

- A. Immediately after seeding, erect barricades and warning signs as required to protect newly planted areas from pedestrian and vehicular traffic. Maintain barricades throughout maintenance period until grass and/or turf is established.
- B. Repair or replace damaged landscape work as directed by Owner.

3.6 MAINTENANCE

- A. Begin maintenance immediately after seed placement.
- B. Watering:
 - 1. Keep soil moist during seed germination period.
 - 2. Supplement rainfall to produce a total depth penetration of 2 inches per day after germination.
 - 3. Prevent erosion and displacement of seed.
- C. Mowing:
 - 1. When grass reaches 4 inches in height, mow to 2-1/2 inches in height.
 - 2. Maintain grass between 1-1/2 inches and 2-1/2 inches in height.
 - 3. Do not cut off more than 30% of grass leaf in a single mowing.
 - 4. Remove grass clippings.
- D. Reseed and mulch spots larger than 1 square foot not having uniform coverage.
- E. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regarding, and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

- F. Maintain and protect all seeded areas until final acceptance of the Contract. Final acceptance of “Turf and Grasses” will not be made until an acceptable uniform stand of grass is obtained in all new lawn areas, except that the Owner at their discretion may accept a portion or portions of the “Turf and Grasses” at various times. Upon acceptance by the Engineer of a seeded area, the Owner will immediately assume responsibility for maintenance and protection of that portion of the Contract Seeding.

END OF SECTION

SECTION 330513 – MANHOLES AND STRUCTURES

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Installation of manholes, catchbasins, precast concrete structures, frames, grates, covers, steps, and piping connections as shown on the Drawings and as specified herein.
 - 2. Alteration of existing structures as shown on the Drawings and as specified herein.
-

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. American Society of Testing and Materials (ASTM).
 - 2. American National Standards Institute (ANSI).
 - 3. Occupational Health and Safety Administration (OSHA).

1.3 SUBMITTALS

- A. Shop Drawings: Submit the following for approval:
 - 1. Design and construction details of all precast concrete units.
 - 2. Fabrication, assembly, and installation details for all castings and miscellaneous metal works.
 - 3. Precast concrete structure design calculations verifying the structures have been designed to withstand the burial, submergence and anticipated live and dead loads. Design calculations for uplift forces shall incorporate a minimum factor of safety of 1.15.
- B. Product Data:
 - 1. Manufacturer's catalog cuts, specifications, and installation instructions.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the site to prevent interruption of the Work.
- B. All materials shall be inspected by the Contractor upon delivery to the site. The Contractor shall notify the Engineer of any loss or damages. Replace loss or repair damage to new condition at the Contractor's expense.
- C. Store materials to allow easy access for inspection and identification.

PART 2 – PRODUCTS

2.1 DESIGN REQUIREMENTS

- A. Design: In accordance with ASTM C890 – Minimal Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
- B. Loading: AASHTO HS-20 with 30 percent impact and 130 pound/cubic foot equivalent soil pressure.

2.2 PRECAST CONCRETE DRAINAGE STRUCTURES

- A. Drainage manholes shall conform to subpart "Precast Concrete Manholes."
- B. Catch basins with greater than 6 feet sidewall depth shall conform to subpart "Precast Concrete Manholes."
- C. Catch basins with less than or equal 6 feet sidewall depth shall be 2-foot 6-inch by 2-foot 6-inch square I.D. precast concrete catch basin units.
- D. Precast catch basin units shall conform to the dimensions shown on the Drawings and as detailed in Shop Drawings approved by the Engineer.
- E. Unless otherwise specified precast concrete units shall conform to ASTM C478.
- F. A precast concrete slab, as necessary for proper frame and grate placement, shall be provided at the top of the catch basin unit. The slab shall be designed for an H-20.

2.3 PRECAST CONCRETE MANHOLES

- A. Precast manhole units shall conform to the dimensions shown on the Drawings and as detailed in Shop Drawings approved by the Engineer.
- B. Unless otherwise specified, manhole sections shall conform to ASTM C478.
- C. Precast structure bases shall be of the "base unit" type, with an integral base and barrel section. The barrels shall be constructed in increments of 1 foot to provide the indicated height with the fewest joints. Openings for pipe connections will not be permitted closer than 1 foot to the nearest joint. Mark the date of manufacture and name or trademark of manufacturer in the inside of each section.
- D. Manholes barrels, servicing pipes less than 27-inch diameter, shall be 48-inch diameter. Manholes barrels, servicing pipes 27-inch diameter and larger shall be 60-inch diameter. Larger diameter manholes barrels shall be provided as indicated on the Drawings or as specified herein.
- E. Joints shall be rubber and concrete using O-ring gaskets (ASTM C443) or butyl rubber gaskets (ASTM C443), or tongue and groove buttered with 1:2 cement mortar (ASTM C270, Type M). A precast eccentric cone, or precast slab where shown, shall be provided at the top of the manhole barrel to receive the frame and cover. The slab or cover shall be designed for an H-20 loading.
- F. Precast manhole units shall be coated on the exterior with a two-coat application of polyamide-cured epoxy-coal tar. Application shall meet manufacturer's recommendations. Do not apply the polyamide-cured epoxy-coal tar within 28 days of concrete manufacture. Epoxy-coal tar to be as manufactured by Coopers Creek Chemical Corporation, Cooper Black #775 Epoxy Tar Coating or approved equal.

2.4 MANHOLE STEPS

- A. Manhole sections shall contain manhole steps at 12 inches on center for all structures over 3 feet 6 inches in height. The steps shall be embedded in the concrete and accurately positioned both vertically and horizontally.

- B. Steps shall be capable of withstanding a 300-pound concentrated live load without permanent distortion, conforming to the requirements of ANSI A14.3, OSHA, and the details shown on the Drawings.
- C. Manhole rungs shall be steel reinforced copolymer polypropylene plastic. Rungs shall be 14 in. wide, M.A. Industries type PS2-PF, or equal. Copolymer polypropylene shall be type II, grade 16906 meeting ASTM D4101. Steel reinforcing shall be 3/8-inch diameter, Grade 60 conforming to ASTM A615 and shall be continuous throughout the rung. The portion of the legs to be embedded in the precast section shall have fins and be tapered to insure a secure bond.

2.5 FRAMES AND COVERS/GRATES

- A. Frames and covers/grates shall be cast iron, ASTM A48, Class 30, free from flaws or unsightly defects.
- B. Frames and covers shall conform to the details on the Drawings and have “STORM SEWER” cast on every cover.
- C. Frames and covers/grates shall be designed for an H-20 loading and be machined to ensure correct fit and even bearing.
- D. Frames and covers/grates shall be as shown on the on the Drawings. Otherwise, conform to the standard detail of the regulatory authorities having jurisdiction for the project (if applicable).

2.6 GRADE ADJUSTMENTS

- A. Grade Rings: Reinforced-concrete rings, 3- to 12-inch (75- to 300-mm) total thickness, to match diameter of manhole frame and cover.

2.7 GROUT

- A. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.8 DROP INLET

- A. Drop inlets for manholes shall be constructed where shown on the Drawings and shall conform with the details shown on the Drawings.
- B. Pipe and fittings shall be the same type and class as the sewer pipe beings installed.
- C. Concrete for pipe encasement shall be 3,000 psi.

PART 3 – EXECUTION

3.1 EARTHWORK

- A. Earthwork shall be in accordance with Section “Trenching and Backfilling” or Section “Earth Moving.”

3.2 PRECAST MANHOLE SECTIONS

- A. Base units shall be placed on a minimum 12-inch foundation of pipe zone bedding material, and be set at the proper elevation, carefully leveled, and aligned.
- B. Barrel units shall be set vertical with steps and sections in proper alignment. All joints shall be sealed with cement mortar inside and out, and troweled smooth to the contour of the wall surface. Joints shall be installed in accordance with manufacturer's recommendations.
- C. Lifting holes shall be sealed tight with a tapered solid rubber plug driven into the hole and the remaining void filled with mortar on the outside only.

3.3 GRADE RINGS

- A. Grade rings placed upon the eccentric cone or slab shall be used for all manholes to provide the potential for future adjustment.
- B. Grade rings shall be placed in a combined thickness of at least 4 inches but not more than 12 inches in order to bring the manhole frame to proper grade.
- C. Consecutive grade ring layers shall be laid on an even mortar bed.

3.4 PIPE CONNECTIONS

- A. Pipe connections to manholes shall be installed true to line and grade as shown on the Drawings. Wall fittings shall be watertight, compatible with the sewer pipe joint. Connections shall conform to the details shown on the Drawings.

3.5 INVERT CHANNEL AND BENCH WALLS

- A. An invert channel and bench walls shall be constructed as shown on the Drawings to provide a smooth transition in flow through the manhole. The invert channel and bench wall shall be constructed of 3,000 psi concrete. Benches shall be built-up to the height called for on the Drawings, or as directed by the Engineer, and given a steel trowel finish. Care shall be taken to slope all benches for proper drainage to the invert channel.

3.6 FRAMES

- A. Frames shall be firmly set and bonded at the proper grade to conform with the finished grade shown on the Drawings.
- B. Frames for manholes in unpaved areas shall be set at an elevation higher than finished grade as shown on the Drawings or as directed by the Engineer.

3.7 WATERTIGHTNESS

- A. All manholes shall be free of visible leakage. Each manhole shall be inspected, and all leaks shall be repaired in a manner approved by the Engineer.
- B. Testing: Manhole Negative Air Pressure (Vacuum) Test shall be performed prior to backfilling and in accordance with ASTM C1244.
 - 1. Preparation of manhole.
 - 2. All lift holes shall be plugged.

3. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipe and plugs to prevent them from being drawn into the manhole during testing.
4. Procedure.
5. The test apparatus shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.
6. A vacuum of 10 inches (254 mm) of mercury shall be drawn on the manhole. The valve on the vacuum line of the test apparatus shall be closed and the vacuum pump shut off.
7. The time shall be recorded for the vacuum to drop to 9 inches (229 mm).
8. If the time recorded exceeds the values in the following table, based on the manhole's depth and diameter, the manhole is acceptable.

DEPTH (FT)	DIAMETER (IN.)		
	48"	60"	72"
	TIME (SEC.)		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97

3.8 CONNECTION TO EXISTING STRUCTURES

- A. The Contractor shall make connections to existing manholes as shown on the Drawings or as specified herein.
- B. For connections to precast or cast-in-place concrete manholes, the Contractor shall core drill a hole 1 inch larger than the O.D. of the sewer pipe into the existing manhole at the location and elevation shown on the Drawings.
- C. For connections to masonry manholes, the Contractor shall open the sidewall of the existing manhole by removing masonry units no more than necessary to accommodate the sewer pipe.
- D. Connection methods shall be in accordance with the details shown on the Drawings. Any open spaces around the new pipe entry shall be sealed with non-shrink grout to prevent leakage.
- E. The existing bench and channel shall be removed and reconstructed to permit flow through the manhole as it now exists and also for the new sewer pipe. Bench and channel reconstruction shall conform with the details on the Drawings, or as directed by the Engineer.
- F. The Contractor shall be responsible for diverting flow through the manhole in order to allow bench and channel construction.

3.9 CHANGING ELEVATIONS OF EXISTING STRUCTURES

- A. Lower existing frames of manholes by the removal of appropriate masonry courses, to the elevations shown on the Drawings or as directed by the Engineer.
- B. Raise the existing frames of manholes by the addition appropriate grade rings to the elevations shown on the Drawings or as directed by the Engineer.
- C. Where the manhole frames cannot be lowered by removal of masonry courses, such as may be the case with precast concrete manholes, the upper barrel section shall be removed and/or replaced with a section of less depth, to permit the necessary adjustment of the frame.
- D. Frames and covers damaged during the Work shall be replaced at the Contractor's expense.

END OF SECTION

SECTION 334100.20 – HIGH DENSITY POLYETHYLENE STORM UTILITY DRAINAGE PIPING

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the installation of polyethylene piping systems as shown on the Drawings and as specified herein.
- B. All piping, fittings, and appurtenances shall be new, clean, and in accordance with material specifications. In no instance shall second- hand or damaged materials be acceptable.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. The latest edition of the following standards, as referenced herein, shall be applicable:
 - a. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).
 - b. American Society of Testing and Materials (ASTM).

1.3 SUBMITTALS

- A. Product Data:
 - 1. Submit manufacturer's catalog cuts, specifications, and installation instructions for both pipe and coupling system.
 - 2. Submit manufacturer's certification that product was manufactured, tested, and supplied in accordance with the standards specified herein.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage:
 - 1. Pipe, fittings, specials, appurtenances, and accessories shall be delivered to and stored within the Contractor's work limits as shown on the Drawings.
 - 2. Special care shall be exercised during delivery and storage to avoid damage to the products.
 - 3. Products shall be stored so as to avoid unnecessary handling and in locations where they will not interfere with the Owner's operations or public travel.
- B. Handling:
 - 1. Pipe, fittings, special appurtenances, and accessories shall be handled carefully with approved handling devices in strict conformance with the manufacturer's recommendations.
 - 2. Products shall not be dropped nor shall products be otherwise dragged, rolled, or skidded.
- C. Products cracked, gouged, chipped, dented, or otherwise damaged will not be approved and shall be removed and replaced at the Contractor's expense, unless the product can be repaired in a manner acceptable to the manufacturer and Engineer. All repairs shall be at the Contractor's expense.

PART 2 – PRODUCTS

2.1 MATERIALS

A. HDPE Soil Tight Pipe:

1. Pipe shall be ADS N-12 ST IB (per AASHTO) smooth interior with annular exterior corrugations and a Manning's "n" value of 0.012 high-density polyethylene pipe (HDPE) as manufactured by Advanced Drainage Systems (ADS) or approved equal. Pipe shall have an integral soil tight gasketed bell and spigot.
 - a. 4 inches through 11 inches conforming to AASHTO M252 Type S.
 - b. 12 inches through 60 inches conforming to AASHTO M294 Type S or ASTM F2306.
2. Pipe shall be joined using a bell and spigot joint meeting AASHTO M252 M294 ASTM F2306. The joint shall be soil-tight and gasketed and shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.
3. Fittings shall conform to ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the soil-tight joint performance requirements of ASTM F2306.

B. Flared End Section:

1. Flared end sections shall be 1210 NP or 1810 NP HDPE end sections as manufactured by ADS or equal.
2. End sections shall be fastened to the last corrugation of the pipe length using a high strength nylon cable tie supplied by the manufacturer through pre-drilled holes at the top of the end section collar.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Inspect all pipe and fittings prior to laying in the trench. Remove defective pipe and fittings from the site.
- B. Do not backfill until inspection by the Engineer, unless otherwise approved by the Engineer.

3.2 INSTALLATION AND TESTING

- A. Trenching, backfilling and compaction shall conform to Section "Trenching and Backfilling."
- B. Pipe installation and testing shall conform to Section "Common Work Results for Utilities."

END OF SECTION