SECTION 32 18 23
SYNTHETIC TURF

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide the complete installation of an infilled synthetic turf system and shock pad from the prepared subgrade to the finished grade within area as indicated on the Contract Drawings.

B. Fine grade subgrade surface to meet subgrade elevations within the area to receive the synthetic turf system.

C. Provide and install reinforced concrete curb.

D. Provide and install geotextile filter fabric over the entire subgrade area to receive the synthetic turf system.

E. Provide, place and compact stone base layers as per requirements of Part 3 Execution, as specified herein and Section 31 20 00 - Earthwork. Protect drainage pipe from damage during grading operations.

F. Fine grade top of synthetic turf stone base to within manufacturer's tolerance for the synthetic turf installation.

G. Furnish and install approved shock pad.

H. Provide and install the complete synthetic turf system from the manufacturer approved by the Landscape Architect.

I. Provide and install access frame kit at goal posts where required on the Drawings.

J. Provide and install sports netting sleeves and foundations where required on the Drawings.

K. Testing and certifying of installed system shall be at the Contractor's expense.

L. Corrective measures as necessary for system to meet the manufacturer's requirements and the performance characteristics specified herein and in Section 312000 Earthwork.

M. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work, as necessary to assure the steady progress of all work of the Contract.

1.2 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements that affect the work of this Section. Other specification sections that directly relate to the work of this Section include, but are not limited to the following:
   1. Section 116833 – Athletic Field Equipment
   2. Section 312500 – Erosion and Sedimentation Control
   3. Section 312000 – Earthwork
   4. Sectuin 321600 - Curbing
   5. Section 321313 – Exterior Concrete
   6. Section 334000 – Storm Drainage Utilities

7. Section 323100 – Fencing

1.3 QUALITY ASSURANCE

A. Manufacturer/Installer Qualifications: The installation contractor for the synthetic turf shall be a certified installer, certified by the manufacturer of the approved turf system. The preparation, construction and installation of the synthetic turf field system shall be completed by a contractor specializing in synthetic turf field construction who shall have completed ten (10) synthetic turf field projects, each 80,000sf or larger, utilizing a similar system proposed for this work, in the last five (5) years. Subcontracted labor and or supervisors are not acceptable. The installer must have at least three years of continuous business under the same name and or organizational structure. Business alliances, joint ventures or partnerships formed to comply with any of these qualification requirements shall not be accepted. The installation contractor shall submit references from all synthetic turf installations they have performed within the past five (5) years to include the Owner's contact name, address and phone number. The manufacturer shall submit references from at least seven (7) installations of the same specified system.

B. To ensure quality control and workmanship, the installation company's supervisor for this project shall be the primary installation company's representative on-site, to oversee the complete installation work. Part-time or replacement personnel will not qualify as the installation supervisor during any part of the installation process, unless the contractor provides written qualifications for the replacement supervisor to the architect for approval. Approval from the architect must be received prior to the replacement personnel's involvement with this installation.

C. The manufacturer's representative shall be present (on site) during the installation process to approve the following system components. Approval of the subgrade preparation and subdrain installation; geotextile filter fabric; drainage stone installation; fine grading of the top of drainage stone and the installation of the synthetic turf.

D. All designs, markings, layouts and materials shall conform to all standards and rules of the applicable state, national and/or international governing body.

E. Source limitations: All components of the Synthetic Turf system shall be provided from a single-source Synthetic Turf System Manufacturer.

F. Seams between turf panels shall be sewn with butt seams. Turf panels shall be 15-feet in width.

G. Field markings shall be tufted in and incorporated into the continuous urethane backing (no seams) of the turf panel rolls during the manufacturing process, to the extent which the approved manufacturer is capable. All other field markings shall be inlaid. Approval by the Landscape Architect is required prior to that start of the inlaid markings

H. 3rd Party Testing: Where specified herein, an independent third party testing agency shall be retained by the Contractor to perform all required testing. Pre-approved testing agencies include:
1. Firefly Sports Testing – Hooksett, NH tel:603-715-5453
2. Labosport – Dalton, GA tel:706-529-9474
3. Sports Laboratories- Chattanooga, TN tel 423-617-6928

1.4 SUBMITTALS

A. Items to be submitted prior to ordering materials:
1. Manufacturer and installer qualifications under item 1.03 herein.
2. Specifications of the turf system components' physical properties and assembled system performance characteristics meeting requirements specified herein and industry standards including certification from the turf manufacturer that lead or lead chromate, and

PFAS/PFOS are not used in the manufacturing of the specified system. Submit manufacturer's specifications and installation instructions for all products in the synthetic turf system, including certifications and other data to show compliance with the Contract Documents and conformance with material environmental and safety standards and regulations.

3. Warranty terms indicating available coverage and terms as specified under item 1.05 herein.
4. Synthetic turf system manufacturer's certification in writing that their turf system, materials, details and/or installation methods do not violate any manufacturers' patents or patents pending. It is the intent of this Section not to infringe upon any existing patents, licenses or rights of individuals or companies.
    a. The Contractor and Subcontractors who have submitted the bid, proposal, or request related to these Drawings and Specifications hereby represent and warrant that the products, materials, and processes identified in their bid, proposal, or request: a) do not infringe any patents or other intellectual property owned or controlled by the third party, and b) are not the subject of any notice, allegation, assertion, claim, or suit by a third party that the products, materials, or processes identified in the bid, proposal, or request infringe a patent or other intellectual property owned or controlled by the third party.
    b. The Contractor and Subcontractors who have submitted the bid, proposal, or request related to these Drawings and Specifications hereby represent and warrant that the products, materials, and processes identified in their bid, proposal, or request: a) do not infringe any patents or other intellectual property owned or controlled by the third party, and b) are not the subject of any notice, allegation, assertion, claim, or suit by a third party that the products, materials, or processes identified in the bid, proposal, or request infringe a patent or other intellectual property owned or controlled by the third party.
5. Provide impact attenuation ASTM F355 (GMAX) and ASTM F1292 Hemisphere Impact Attenuation (HIC) test results of the specified system from prior installations. The test results submitted shall demonstrate that the synthetic turf system for this project shall have a GMAX value as specified herein, that shall not exceed 120 GMAX and a HIC value below 1,000 at 1.4 meters during the warranty period or the system's life expectancy.
6. Submit manufacturer's product data, installation instructions, warranty(s) along with material component samples and a sample of the assembled system (approximately one (1) square foot).
7. Submit a shop drawing plan at 1"=30' containing all pertinent information regarding installation. Provide a seaming plan at 1"=30', edge details.
    a. Mock up:
        1) Upon acceptance of the completed submittal, the installation contractor shall construct a 2-foot by 2-foot or larger mock up panel on site for approval by the Architect and Owner. The mock up shall include one seam and one edge of the assembled sample, which shall include a tufted line of each color specified, inlaid through the middle to depict materials, color and workmanship.
        2) The mock up panel shall be representative in every way of the composition, strength, color, texture, installation details, and performance of the material to be assembled as the finished system and may be tested for comparison with submitted test data.
        3) The mock up shall be used as a quality and performance datum for comparison to the finished installation.
8. Submit one (1) quart sample of organic/sand turf infill mix at the proper mix ratio.
9. Submit a sample of the shock pad underlayment.
10. Submit the full range of fiber colors for selection.
11. Submit a minimum 18-inch square sample of turf carpet including stitched seam.
12. Lead Test to meet 2015 CPSC requirements. Not to exceed 50 P.P.M. Refer to section 1.07 as specified herein.

13. Lab Test Results demonstrating the submitted turf system complies with all One Turf Concept performance and longevity guidelines.
14. Testing confirmation surpassing 200,000 Lisport Cycles as certified by a 3rd party independent testing agency.

B. Items to be submitted after manufacturing but prior to installation:
1. Post manufacturing/pre-shipment test results from an independent lab for carpet identification shall include tuft bind, pile height, pile weight, carpet mass, tuft count, Dtex values, lead content in parts per million and EPA Method 537 Modified test results showing non-detect (ND) for 30 PFAS compounds.

C. Item to be submitted during installation and prior to substantial completion:

1. Compaction, planarity and permeability (infiltration) test results as specified herein demonstrating conformance with specified performance requirements, at least one week prior to installation of the shock pad.
2. Seam strength testing in accordance with EN 12228 Method 1. Three (3) samples minimum. Seam strength shall be greater than or equal to 300lbs/ft.
3. Dimensional stability test results in accordance with ASTM D1204 (modified) Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting of Film at Elevated Temperatures. Three (3) samples minimum.
4. The synthetic turf manufacturer/installer shall submit written certification of their acceptance of the following substrate components, installation and properties prior to installation of the synthetic turf system. Such certification shall be based on field verification of installed conditions and shall include dated and time-stamped photographs documenting these stages of construction.
    a. Gradation, proctor and permeability test results on samples submitted for the bottom and top drainage layer materials for the base construction of the field.
    b. Subgrade preparation for proper depth, slope and fine grading prior to installation of the geotextile filter fabric.
    c. Installation of the filter fabric, sub drain pipes and drainage base installation. Drainage base approval shall include acceptance of the compaction, planarity, permeability and stability of the base.
5. Manufacturer's review: Submit written statement signed by the Contractor and synthetic turf 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.
6. Submit delivery slips for all Synthetic Turf system materials delivered to the site, to the Owner's representative upon delivery of materials.

D. Items to be submitted prior to final completion:
1. Submit a written statement signed by the manufacturer stating that the field supervision of the manufacturer's representative was sufficient to ensure proper application of the materials, that the work was installed in accordance with the Contract Documents, and that the installation is acceptable to the manufacturer.
2. Provide warranty materials as specified herein, properly executed and registered with the Manufacturer, Contractor and insurance carrier.
3. Provide GMAX, HIC, LEAD, ADA and One Turf Concept testing, as specified herein under item 1.04 & 1.07, and As-Built survey results verifying that the performance of the installed system, meets all requirements of this specification and applicable safety standards and requirements.
4. Provide on-site One Turf Concept testing for performance and longevity on the installed field.

5. Provide three copies of Maintenance Manuals and one (1) digital copy in PDF format, which include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.
6. Provide extra and additional materials to the Owner:
   a. One contiguous green piece of synthetic turf 15' wide by 15' long from the same production run as the turf supplied to this project, as well as all salvageable remnants from the installation.
   b. Two hundred pounds of specified sand.
   c. Five hundred pounds of specified organic infill.

1.5 WARRANTY

A. The synthetic turf provider shall provide an eight (8) year pre-paid warranty that is insured by a policy of insurance issued by a reputable insurance company and must have the following policy features:
   1. Stating that all work executed under this Section will be free from defects in material and workmanship without limitations for a period of eight (8) years from the date of Substantial Completion, and that any defects will be remedied on written notice at no additional cost to the Owner.
   2. Coverage of all materials and labor shall provide for all costs up to and including the full value of a complete re-installation of the synthetic turf system and all preparation and disposal costs.
   3. This warranty shall include all components of the system in its coverage.
   4. The manufacturer shall warrant that materials and their performance shall meet or exceed the product specifications.
   5. The warranty shall not limit the types of sports and recreation activities or uses that are typical of similar soccer and football field installations.
   6. The insurance premium for this coverage shall be paid in full for the entire length of the warranty.
   7. Insurance coverage shall specifically provide for reimbursement to the warranty holder in the event of bankruptcy of the synthetic turf provider.
   8. Insurance coverage shall apply to playing surface inclusive of infill, seaming, labor and colored inlays for event markings.
   9. Provide the following documents with bid: Warranty Certificate, Accord Certificate, the actual Insurance Policy, and proof of A.M. Best Rating for the insured warranty provider.
   10. Insurance coverage shall apply to the full 8 year period from completion date of project, with no uninsured periods or periods of self-insurance.
   11. Insurance is provided by a third party insurer with an A.M. Best financial strength rating of "Excellent" or higher.
   12. Insurance coverage shall not have exclusions for epidemic or catastrophic failure.
   13. Insurance coverage shall not limit the hours of use.
   14. Insurance coverage shall not exclude heavy trafficked areas or related uses such as team or band practices.
   15. Insurance coverage shall not exclude any colored turf fibers.
   16. Insurance coverage offers a minimum claim limit of $5 million in the aggregate per annum.
   17. Insurance coverage offers a minimum claim limit of $ 300,000 per field.
   18. Provide the actual executed Policy from the insurance carrier.
   19. Include certified evidence that the manufacturer has in place a minimum of $500,000.00 in cash in a separate warranty reserve account for small warranty repairs.

B. Response time to perform emergency warranty repairs shall not exceed 24 hours from the time of contact. The warranty shall guarantee the availability of replacement material for the synthetic turf system for the full warranty period. The warranty shall state that the intended use as a multi-purpose field for training and games including the use of cleats is covered under the material and workmanship warranty.

C. Starting with the completion of construction, the synthetic turf manufacturer/installer shall retain a third party (independent) certified testing laboratory approved by the Owner to perform shock absorption testing once each year during the life of the Warranty in accordance with ASTM F 1936 and ASTM F 355 (G-Max) and ASTM 1292. Testing shall be performed at the field's center, the goal locations for all sports and 10 yards inside each corner. G-Max shall not change more than 5% at any one location per year over the life of the guarantee and at no time shall be less than 85 or greater than 125 at any one point of the field. HIC value at installation and over the life of the guarantee shall be below 1,000 at 1.4 meters for each location. In cases where the results of the testing fall outside this range, the condition shall be repaired and the G-Max re-tested by the manufacturer to return the field to within the specified range.

D. Within the first 3 months after final acceptance, the turf installation contractor shall replenish the specified infill material to the required depth at no additional cost to the Owner if the depth of the infill is found to have settled to be less than the specified depth throughout the field surface during that timeframe. Only a + tolerance of 1/8" will be accepted for infill depths.

1.6 PROJECT CONDITIONS AND COORDINATION

A. Weather: The turf contractor shall perform work only when permitted by weather conditions meeting the manufacturer's requirements. No part of the construction shall be conducted during a rainfall or when rainfall is imminent.

B. Coordination: The turf installation contractor shall coordinate work with the General Contractor and his subcontractors. Specific attention is called to the required coordination at all edges of the synthetic turf field area.

1.7 REFERENCES

A. Comply with all local, state and federal codes and regulations, including all ADAAG regulated testing. Comply with applicable requirements of the latest editions of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.

B. American Society of Testing and Materials (ASTM).
1. C 131 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
2. D 395 Rubber Property – Compression Test.
3. D 418 Pile Yarn Floor Covering Construction.
4. D 422-63 Particle Size Analysis.
5. D 1335 Tuft Bind of Pile Floor Coverings.
6. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort.
7. D 1577 Linear Density of Textile Fibers (Denier).
8. D 1682 Breaking Load and Elongation of Textile Fabrics.
9. D 2256 Breaking Load (Strength) and Elongation of Yarn by the Single-Strand Method.
10. D 2434 Permeability of Granular Soils (Constant Head).
11. D 3776 Mass Per Unit Area (Weight) of Woven Fabric.
12. D 3786 Hydraulic Bursting Strength of Knitted Goods and Non-Woven Fabrics: Diaphragm Bursting Strength Tester Method.
13. D 4491 Water Permeability of Geotextiles by Permittivity.
14. D 4533Trapezoid Tearing Strength of Geotextiles.
15. D 4632Breaking Load and Elongation of Geotextiles (Grab Method).
16. D 4833Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.
17. D 5034 Breaking Strength and Elongation of Textile Fabrics (Grab Test).
18. D 5034-05 Breaking Strength and Elongation of Textile Fabrics (Grab Test Modified for Seam Strength).

19. D 5848 Mass per Unit Area of Pile Yarn Floor Coverings.
20. E1792-96E Standard Specification for Wipe Sampling Materials for Lead in Surface Dust.
21. F 355 Shock Absorbing Properties of Playing Surface Systems and Materials (GMAX).
22. F 1551-97 Comprehensive Characterization of Playing Surface Systems and Materials.
23. F 1936 Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field.
24. F2765 Total Lead Content in Synthetic Turf Fibers.

C. British Standards Institution.
   1. BS 7044, Method 4 Double-ring Infiltrometer (At Owner's discretion).

D. Massachusetts Department of Transportation Standard Specifications for Roadways and Bridges.

E. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).

F. American National Standards Institute (ANSI).

G. Consumer Protection Safety Commission (CPSC).

H. Occupational Health and Safety Administration (OSHA)

I. Environmental Protection Agency (EPA).

J. Town of Billeria Engineering Department Standards and Specifications

K. American Concrete Institute (ACI).

L. Synthetic Turf Council Guidelines (STC) www.syntheticturfcouncil.org.

M. American Sports Builders Association Guidelines (ASBA) www.sportsbuilders.org.

N. Massachusetts Interscholastic Athletic Association (MIAA) www.miaa.net.

O. National Federation of State High School Associations (NFHS) www.nfhs.org.

P. National Collegiate Athletic Association (NCAA) www.ncaa.org.

Q. International Amateur Athletic Federation (IAAF) www.iaaf.org.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver manufactured materials in original packages with seals unbroken and bearing manufacturer's labels indicating brand name and directions for storing.

B. Store manufactured materials in a secure, clean and dry location protected from the weather, vandalism and deterioration, and complying with manufacturer's written instructions for minimum and maximum temperature requirements for storage.

C. Store rolls of synthetic turf horizontally on flat surfaces. Do not stand or stack rolls upright.

PART 2 - PRODUCTS

2.1 DRAINAGE BASE AND AGGREGATE

A. Drainage stone for bottom and top layers indicated on the contract drawings shall be in accordance with Section 312000 Earthwork

B. Geotextile Filter Fabric:
1. Non-woven polypropylene geo-textile fabric shall be chemically and biologically inert and shall be equivalent to the following:
a. Mirafi 140N, TenCate Geosynthetics North America, Pendergrass, GA 706-693-2226.
b. 140EX, LINQ Industrial Fabrics, Inc. Summerville, SC 800-445-4675.
c. C45NW, CONTECH Construction Products Inc. West Chester, OH 800-338-1122.

C. Subdrains:
1. Corrugated Plastic (Polyethylene) Pipe (HDPE) Collector Drains shall be flexible, prefabricated composite product, with a rounded rectangular shape wrapped in geotextile fabric. Rolls shall be 12” wide. The system core shall be made of high-density polyethylene with perforation evenly distributed on both faces of the core. The core collection system shall conform to the following physical properties:

Thickness (1”)	ASTM D-1777
Outflow Rate, gpm/ft (29)	ASTM D-4716
Compressive Strength, psf (6000)	ASTM D-1621
Perforations / sq. ft.	≥ 300

2. The quality of standard, design and function desired is based on Multi-Flow system, manufactured by Varicore Technologies, Inc. (800) 978-8007.
3. Additional acceptable manufacturers include (or approved equal):
a. ADS 1-800 821-6710.
b. Invisible Structures, Inc. 1.800.233.1510.

2.2 CAST-IN-PLACE CONCRETE TURF EDGER

A. Concrete for Cast-in-Place Turf Edger shall have a 28-day compressive strength of at least 4,000 pounds per square inch. Higher minimum compressive strength indicated in the drawings and/or specifications for individual improvements shall govern see section 32 13 13 Exterior Concrete.

B. Concrete shall include fiber reinforcing as specified in Section 321313 Exterior Concrete.

C. Provide smooth broom finish at all exposed turf edger.

D. Fence posts shall be embedded directly within curb edger as indicated on the Drawings. Fence posts surfaces shall remain free and clear of dirt and debris as well as remain free of damage as a result of the concrete work.

E. Sawn control joints at a maximum 20 feet spacing or as indicated in the Drawings shall be perpendicular to turf edger and penetrate 1 inch minimum into edger. Care should be taken to avoid chipping or damage to turf concrete edger.

2.3 SYNTHETIC TURF SURFACE & INFILL SYSTEM

A. The complete permeable and infilled synthetic turf system submitted to and approved by the Landscape Architect and Owner shall be one of the following specified systems and shall meet all requirements specified herein including, but not limited to, Item 1.03 Quality Assurance, Item 1.04 Submittals and 1.05 Warranty. No other systems will be considered without comprehensive

demonstration submitted by the Contractor that an alternative clearly meets all specified material, performance and qualification requirements.

1. DFE Extreme by Sprint Turf, Atlanta, GA represented locally by Andrew Giobbi tel 202-403-4348
2. Rhino Blend by Astroturf, Dalton, GA, represented locally by Dave Wheaton tel. 413-426-3789
3. Legion NXT (with Thunderbolt Monofilament) by Shaw Sports Turf, Calhoun, GA, represented locally by Aaron Gobel tel 202-503-6468

B. The synthetic turf system shall be considered "PFAS/PFOS free" according to REACH and PROP 65. Turf system shall be non-detect (ND) for 30 PFAS compounds tested via EPA Method 537Modified and have a statement from the vendor that the turf does not contain and is not manufactured with PFAS/PFOA.

C. Synthetic Turf Surface:
1. Physical properties and performance characteristics of the synthetic turf components and system shall meet the manufacturer's standard specifications for the approved synthetic turf system and the following criteria. The criteria ranges indicated below are intended to permit the variations inherent between the specified turf systems, and do not suggest that such ranges would be acceptable in the finished installation of a particular system. The finished installation of the approved synthetic turf system must have uniform materials and performance throughout the field area.

Polyethylene Fiber Denier	Monofilament-10,800 (min) Slit Film -10,000 (min)
Pile Height	2 inches
System Permeability	>20 inches/hour minimum
Impact Attenuation (GMax)	110 minimum to 165 maximum
Pile Weight	50-55 ounces/square yard
Tuft Bind Strength	> 8 lbs.
Breakload	18 PSI minimum per ASTM D 2256
Elongation at Break	47% minimum per ASTM D 2256
Grab Tear (Width and Length)	>250 lbs/ft

a. Yarn shall be a UV resistant, multi-structured/parallel fiber extruded of monofilament and slit film polyethylene grass-like fibers with a finished pile height of 2 inches with a +1/8" height tolerance after any shrinkage from manufacturing tufted into a dimensionally-stable primary backing with a secondary urethane backing. Turf systems using yarn or ribbon that shrinks during the manufacturing process shall oversize pile height so that the finish product including any process related shrinkage meets these requirements. Height shall be measured after heating processes that would shrink the fibers. Process related fiber shrinkage shall not relieve the manufacturer from providing a full 2.00-inch product.

b. The turf shall be suitable for all field sports, marching band, and all normal activities held on athletic fields. Color shall be standard field green .

c. Turf shall surpass 200,000 Lisport Cycles as certified by a 3rd party independent testing agency.

d. Provide tufted and inlaid markings where required per drawings installed in accordance with the manufacturer's recommendations. Lines shall be tufted within the 15-foot wide rolls to the maximum extent possible.
   1) White for football markings
   2) Blue for boys lacrosse, Red for girls lacrosse
   3) Tick marks: Yellow/Gold for soccer markings

e. Provide Dimensional Stability layer in turf backing.

f. Glued seams: Seaming tape and adhesive shall meet the approved synthetic turf manufacturer's requirements and minimum performance characteristics specified herein.

   1) Adhesives for bonding tufted synthetic turf shall be one-component fast-set urethane adhesive obtained from a single manufacturer and be equivalent to Ultrabond Turf PU 1K as manufactured by Mapei Corporation, Deerfield Beach, FL (800) 992-6273, or approved equal.

   2) Tape for securing seams in the tufted synthetic turf and inlaid lines shall be high quality tape made with a minimum roll width of 12 inches.

D. Infill Material:
1. The composite infill shall be a homogeneous blend of sand and plant-based organic infill granules unless patents allow for other approved compositions.
2. BrockFill or Safeshell plant-based infills shall be combined at a ratio of 80% sand and 20% plant-based infill by weight with sand content between 4.5 to 5 lbs/SF or 18mm in depth. Corkonut by GreenPlay Organics LLC shall be combined at a rate of 70% 66.7% sand to 30% 33.3% plant-based infill by weight with sand content of 4 lbs/SF or 15mm in depth. Total depth of infill shall be a minimum 38 mm with a + tolerance of 4mm. Additional plant-based infill may be required to achieve infill depth requirements.
3. Sand shall be a 20-40 round to sub-round; dust-free, meeting the following Particle Size Distribution:

Sieve Size Mesh	Min % Retained	Max % Retained
8	0	0
10	0	0
12	0	0.1
14	0	0.5
16	0	15
20	10	60
30	10	90
40	0	40
50	0	5
60	0	0.5
70	0	0.5
100	0	0.5
pan	0	0.5
	Total – 50M	<1

a. Krumbein #must be $\geq$ to 0.4.
b. API Crush – 50M fines generation at 80 psig: $\leq$ 0.4%.

4. Plant-based Organic infill shall be Brockfill by BrockUSA, Boulder, CO, or approved equal, locally represented by Eric Hughes tel 781-883-9663

    a. Alternate products: Safeshell by US Greentech, Cincinnati, OH tel 888-323-0721 or Corkonut by GreenPlay USA tel 516-223-0202
    b. Material requirements
        1. 100% plant-based organic material free of pesticides and heavy metals by AOAC Method 2007.01
        2. Infill shall be manufactured from sustainably harvested sources.
        3. Vertical drainage that exceeds the synthetic turf product using ASTM 1551.
        4. Resistant to degradation in accordance with BS EN 933-1:2012. 80% shall fall between 0.8mm – 2mm.
        5. Hydrophilic, absorptive of rain and condensation.
        6. Min. bulk density of 15lbs/cu ft.
        7. Infill shall not float
        8. Shall provide a minimum 8-year warranty.

5. Total depth of infill shall be a minimum 1.26 inches in depth (72% of the fiber height), with a + tolerance or 1/8” only.

2.4 RESILIENT UNDERLAYMENT

1. Submittals:
    a. Product Data: Submit 8” x 8” product sample and technical data sheet.
    b. Shop Drawings: Submit cross-sectional view showing product installation in relation to sub-base and synthetic turf (including edge attachment).
    c. Test Data: Submit listing of all applicable test data for compliance to specifications. All testing to be performed by independent sources following applicable ASTM or other internationally recognized standards and procedures.
    d. Installation: Submit copy of product installation instructions. Submit copy turf installation recommendations.
    e. Warranty: Submit copy of product 16 -Year warranty coverage.
2. Shall be SP-17™ by Brock® and as supplied by Brock International, Boulder CO 80301, (303) 544-5800, or approved equal. Additional acceptable expanded polypropylene shock pad products include these sources:
    a. ShockWwave Ecobase, www.nottssport.co.uk
    b. UltraBaseMAX, www.ultrabasesystems.com

3. Underlayment shall be 17 mm thick expanded polypropylene designed for athletic fields. Material thickness shall be based upon product thickness needed in order to meet the system performance requirements.
4. GMax shall be between 85-120 throughout warranty period and must not exceed 120 for the life of the turf/infill/pad system.

5. The complete synthetic turf system including shock shall meet minimum critical fall height of 1.4m per IRB Reg 22 and One Turf Concept at installation and throughout the warranty period. HIC not to exceed 1000 on pad from a 1.4m drop height of for the life of the system.
6. Product shall drain at greater than 300 inches per hour.
7. Warranty shall be 16 years or more and cover the cost to replace or repair the turf in affected area in the event of product failure. Warranty must guarantee the turf/pad system not to exceed 125 Gmax for the life of the turf with no less than 1" of infill.
8. Recycled expanded polypropylene content shall not exceed 30 percent.
9. When tested with the Deltec field tester, vertical deformation must remain between 7-11mm.
10. Supplier must provide documentation that product meets human health screening levels and total threshold limit concentration using EPA Method 3052 and Title 22 (CAM 17) metals using EPA Method 6020/7471A and for hexavalent chromium using EPA Method 7196A.
11. Manufacturer must prove absence of heavy metals in production material, and a controlled chain of custody for all materials used.
12. All material used in the artificial system must meet environmental and human health standards established in this specification. Documentation of chain of custody for materials may be required.
13. Product must be of a homogeneous material composition. Variable material content will not be accepted

2.5 SUBDRAINS AT TURF FIELD

A. Furnished and installed under section 33 40 00 Storm Drainage.

2.6 SYNTHETIC TURF MAINTENANCE EQUIPMENT

B. Provide one (1) Synthetic Sports Turf Groomer with integrated Spring Tine Rake for routine maintenance of the synthetic turf field. Maintenance equipment shall be Model# 920SDE as provided by GreensGroomer WorldWide, Inc. PO Box 34151, Indianapolis, IN 46234. 888-298-8852, or equal as approved by the Landscape Architect.

4. Sports Turf Groomer shall be:
   a. Towable product.
   b. Constructed of steel tube with powdercoat finish.
   c. Length shall be minimum of 48" and minimum width of 72"
   d. Groomer shall have an electric lifting mechanism to lift the brushes and spring tines off the field surface.
5. Spring Tine Rake Attachment shall be:
   e. Attachable product compatible with the Turf Groomer product
   f. Frame shall be constructed of steel with powdercoated finish

g. Width shall be minimum 72”

h. Tines shall be 3/16” diameter with a tip bend between 38-42 degrees.

i. Three (3) rows of tines with each row consisting of 12-14 tines. Tines shall be spaced 7/8” apart. Tines shall be offset from the other rows.

j. Each row shall be independently adjustable for depth and allowed to be set in a forward or backward position for various levels of aggressive raking.

k. Rake attachment shall be able to fully retract the tines allowing the rake to remain attached to the groomer when not in use.

2. Provide one (1) LitterKat Synthetic Turf Sweeper with Tow-magnet as provided by GreensGroomer WorldWide, Inc. PO Box 34151, Indianapolis, IN 46234. 888-298-8852, or equal as approved by the Landscape Architect.

6. Sports Turf Sweeper shall be:

a. Towable product

b. Steel Construction with powdercoat finish

c. Width shall be a minimum of 72”

d. Sweeper shall be direct drive gear drive

e. Debris basket shall be removable

f. Sweeper shall have an electric lifting actuator to lift basket and sweeping brush off the field surface.

7. Magnet bar shall be:

a. Towable product
b. Width shall be minimum of 72” , depth of minimum 5” , height of 2” minimum

2.7 SYNTHETIC TURF AT BATTING TUNNEL

A. To establish the standard of quality, design, aesthetics and function desired, Drawings and Specifications are based on “SYNSport” available from SYNLawn (www.synlawn.com) 55 Fulton St #100, Canton, MA 02021 Phone (781) 821-01112

a. Additional acceptable manufacturers are noted below provided they meet the performance and aesthetics specifications of realistic looking lawn with multi-color blades.

1. X-Grass, parent company Challenger Industries, Dalton, GA. Tel 877-881-8477
2. ForeverLawn, Louisville, OH Tel: 866 992 7876
3. Or approved equal.

B. Synthetic Turf must meet or exceed the following criteria and physical properties

1. Grass Zone Yarn/Color - Field Green
2. Grass Zone Denier - 10800/6

3. Thatch Zone/Yarn/Color - PE/Field Green/Beige
4. Thatch Zone Denier - 5,000/8
5. Grass Zone Yarn Shape - Soft Omega
6. Finished Pile Height - 1
7. Finished Pule Weight - 58 oz.
8. Backing - 15/18 PP 2-Part/22oz Enviro.Loc
9. Tuft Gauge - 3/8”
10. Tuft Bind - > 8 lbs
11. Permeability - > 300 inches per/SY

C. Glued seams: Seaming tape and adhesive shall meet the approved synthetic turf manufacturer’s requirements and minimum performance characteristics specified herein

a. Adhesives for bonding tufted synthetic turf shall be two-component fast-set urethane adhesive obtained from a single manufacturer and be equivalent to Ultrabond Turf PU 2K as manufactured by Mapei Corporation, Deerfield Beach, FL (800) 992-6273, or one-part moisture-cured polyurethane obtained from a single manufacturer and be equivalent to 34-G as manufactured by Synthetic Surfaces, Inc., Scotch Plains, NJ (908) 233-6803, or approved equal.

b. Tape for securing seams in the tufted synthetic turf and inlaid lines shall be high quality tape made with a minimum roll width of 12 inches.

D. Infill –Sand shall meet the material requirements specified within this Section 321823.

E. Turf Anchor shall be ACQ PT southern yellow pine #2 grade or better.

PART 3 – EXECUTION

3.1 COORDINATION

A. The work of this Section shall be performed in full compliance with all approved submittals and certifications, and in conformance with the approved manufacturer’s recommendations and requirements.

B. The synthetic turf manufacturer’s representative shall inspect all adjacent site conditions and verify that they are in proper condition to receive the work described within this Section. Notify the Engineer of any condition that may potentially affect proper execution of the work. Beginning work of this Section means acceptance of existing substrate surfaces and site conditions.

3.2 SUBGRADE

A. Fine grade existing subgrade in accordance with the approved manufacturer’s requirements. Upon completion of fine grading, the contractor shall measure the subgrade elevations with a laser level at a minimum of 100 evenly spaced points throughout the field area. Written approval of the subgrade elevations by the manufacturer’s representative is required prior to placement of geotextile and drainage base materials.

3.3 GEOTEXTILE FILTER FABRIC

A. Geotextile filter fabric shall be placed over the entire surface of the approved subgrade,

including under the sub drains. Overlap joints a minimum of twelve (12) inches. Prevent any soil contamination of the underdrains to provide a clean connection to the drainage layer under the synthetic turf field.

3.4 DRAINAGE STONE & SUBDRAINS

A. Install the sub drains within the bottom drainage layer as indicated on the Drawings. Bottom and top layers of drainage materials meeting the manufacturer's engineered criteria for this project, shall be placed and compacted in accordance with the manufacturer's installation requirements. A minimum of two (2) separate layers of drainage materials placement will be required.

B. Drainage stone shall be placed as per requirements of Section 312000 Earthwork. To prevent segregation of different aggregate sizes handling of the base stone material shall minimized. The finished surface of the top drainage stone layer shall be fine graded in preparation of measurement. The contractor shall measure the top drainage stone layer at a minimum of 100 evenly spaced points throughout the field area with a laser level to attain the required elevations. Surface tolerance shall not exceed 3/16 inch in ten feet. Infiltration of the Drainage Stone shall be no less than 40 inches per hour (40"/hr) or as noted with Section 31200 Earthwork, whichever is greater. Written approval of the drainage base by the manufacturer's representative is required prior to installation of the synthetic turf system.

C. Placing, Spreading and Compacting Base Stone Material at Synthetic Turf Field:

1. Fill materials are to be placed as designated herein and as indicated on the Contract Drawings.
2. Base Stone shall be placed as follows and compacted as specified herein: As a base course, compacted subgrade, as shown on the Drawings.
3. Finishing Top Stone shall be placed as follows and compacted as specified herein: Finishing Stone shall be 1" compacted depth above Base Stone as shown on the Drawings.
4. After each layer has been placed, it shall be thoroughly compacted to the specified density. Compaction shall be continuous over the entire area and the equipment shall make sufficient passes to ensure that the desired density is obtained. A minimum of four coverage's with acceptable compaction equipment is a requirement.

3.5 COMPACTION

A. Compaction Requirements: The degree of compaction as shown on the drawings shall be in accordance with section 312000 Earthwork

1. Laser grading shall be used in the construction of the stone base material for the Synthetic Turf fields.

B. The contractor shall provide base stone and top stone testing by a 3rd party for infiltration, planarity and compaction by an approved testing agency specializing in synthetic turf fields.

3.6 SHOCK PAD

A. Protect the shock pad material from direct exposure to sunlight during storage.

B. Install the shock pad in strict accordance with the manufacturer's recommendations. Shock pad installation shall be completed by the Synthetic Turf Installer and/or by a contractor certified by the approved shock pad manufacturer. An official representative from the shock pad manufacturer shall be present on the site at the commencement of the installation.

C. The synthetic turf and shock pad shall be installed simultaneously. In order to reduce movement or damage, the shock pad shall only be installed as far ahead as 2 turf rolls and

shall be completely covered at the end of each work day.

D. As the infill is placed in on top of the turf, secure the shock pad to avoid shifting movement of line markings. Replace or reposition any panels that are shifted or damaged.

3.7 SYNTHETIC TURF SYSTEM

A. The accepted synthetic turf system shall be installed in accordance with the manufacturer's requirements and in coordination with the manufacturer's representative such that the manufacturer will certify the acceptability of the installation from subgrade to the finished synthetic turf system in writing.

B. Provide all materials, labor and equipment necessary to perform turf installation including, but not limited to, water and rollers to maintain stability and planarity of approved base.

C. Attach the synthetic turf to the perimeter edge detail in accordance with the manufacturer's recommendations.

D. After a final inspection of the prepared base by the Field Builder and the Owner's Representative, the synthetic turf installation shall begin. The first roll shall begin with the longest perpendicular cross-field distance. Pile lay shall be in accordance with the approved shop drawings. No head seams shall be permitted.
   1. All visible wrinkles shall be stretched out before seaming.
   2. Seams shall be flat, tight and permanent with no separation or fraying.

E. Seams shall be glued without bulging in the backing material. Visible seems in the finished installation are not acceptable. Seaming tape shall extend a minimum of 6" in all directions from any material joint.

F. The adhesive shall extend at it's full application rate a minimum of 4" in all directions from any material joint.

G. The adhesive shall be applied at the adhesive manufacturers' recommended application rate at 99% efficiency.

H. All seams shall have a min. grab tear strength of 150 lbs and 5% elongation based on ASTM D5034-05.

I. When all rolls of the playing surface have been installed, the sideline areas shall be installed perpendicular to the playing field.

J. Install inlaid field markings to complete the tufted markings for football, and lacrosse layouts and tick marks at soccer in accordance with the approved shop drawings and applicable standards.

K. After all seaming and inlaid markings are complete, the plant-based and sand infill shall be spread evenly using a drop spreader or topdresser in accordance with the manufacturers' recommendations.
   1. Infill shall be applied in a uniform rate of multiple applications until the required infill depth is achieved.
   2. Infill material shall be brushed between infill applications with a motorized rotary broom and pull-type groomer brush simultaneously. Apply layers with a stiff bristle broom to stand fibers up and allow infill to settle into the bottom.
   3. A minimum infill rate of 6 lbs. per square foot is required based on the ratio of plant-based infill to sand specified herein.
   4. Presence of wrinkles in the synthetic turf and evidence of inadequate ballast will require additional sand.

L. Synthetic Turf Perimeter Attachment: After final trimming of the turf, the turf shall be attached to the curb in accordance with the manufacturer's recommendations using

mechanical fasteners and adhesive. The edges shall be secure and have a neat and smooth transition to adjacent surfaces

3.8 SYNTHETIC TURF AT BATTING TUNNEL

A. Install synthetic turf play lawn in accordance with these specifications, the drawings and the manufacturer's recommendations.

1. Provide all site preparation required to install edging, prepare base and install turf.
2. Furnish and install prepared gravel base in accordance with Section 312000 Earthwork.
3. The accepted synthetic turf system shall be installed in accordance with the manufacturer's requirements and in coordination with the manufacturer's representative such that the manufacturer will certify the acceptability of the installation from subgrade to the finished synthetic turf system in writing.
4. Provide all materials, labor and equipment necessary to perform turf installation.
5. After a final inspection of the prepared base by the Owner's Representative, the synthetic turf installation shall begin.

    a. All visible wrinkles shall be stretched out before seaming.

    b. Seams shall be flat, tight and permanent with no separation or fraying.
6. Seams shall be glued without bulging in the backing material. Visible seems in the finished installation are not acceptable. Seaming tape shall extend a minimum of 6" in all directions from any material joint.
7. The adhesive shall extend at its full application rate a minimum of 4" in all directions from any material joint.
8. The adhesive shall be applied at the adhesive manufacturers' recommended application rate at 99% efficiency.
9. After all seaming and inlaid markings are complete, sand infill shall be spread evenly at 3lbs/sf using a drop spreader or topdresser in accordance with the manufacturers' recommendations.

    a. Infill shall be applied in a uniform rate of multiple applications until the required infill depth is achieved.

    b. Infill material shall be brushed between infill applications with a motorized rotary broom and pull-type groomer brush simultaneously. Apply layers with a stiff bristle broom to stand fibers up and allow infill to settle into the bottom.

    c. A minimum infill rate of 3 lbs. per square foot is required.

    d. Presence of wrinkles in the synthetic turf and evidence of inadequate ballast will require additional sand.
10. Synthetic Turf Perimeter Attachment: After final trimming of the turf, the turf shall be attached to the edger in accordance with the manufacturer's recommendations using mechanical fasteners and adhesive. The edges shall be secure and have a neat and smooth transition to adjacent surfaces.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Prior to Owner acceptance of the synthetic turf installation, the Synthetic Turf

Manufacturer/Installer shall engage an independent testing agency approved by the Landscape Architect to perform permeability, G-Max and HIC testing in accordance with the testing methods referenced herein and according to the Synthetic Turf Council's recommendations.

B. Layout Verification: Prior to Owner acceptance of the synthetic turf installation, the Synthetic Turf Manufacturer/Installer shall engage a Professional Engineer or Registered Land Surveyor to verify the sizes and locations of the football and soccer field locations.

C. Remove and replace or install additional materials as necessary where test results of measurements indicate non-conforming conditions to specified requirements or industry standards.

3.10 OWNER TRAINING

A Upon completion of the synthetic turf installation, the synthetic turf manufacturer/installer shall provide training in person for the proper care and maintenance of the synthetic turf system at up to two (2) meetings with the Owner's maintenance personnel. Provide submittals in accordance with Article 1.4 herein.

3.11 CLEANING, REPAIR AND PROTECTION

A. The turf installation contractor shall provide all labor, materials and equipment for cleaning, repair and protection of the installation to the satisfaction of the Landscape Architect.

B. Within the first 3 months after final acceptance, the turf installation contractor shall replenish the specified infill material to the required depth at no additional cost to the Owner if the depth of the infill is found to have settled to be less than specified throughout the field surface during that timeframe.

3.12 CLOSEOUT

A. The synthetic turf representative must verify that a qualified representative has inspected the installation and that the finished field surface conforms to the Manufacturer's requirements.

B. The synthetic turf manufacturer shall provide the warranty, training and maintenance manual specified herein.

C. Extra materials: Contractor shall leave specified attic stock, surplus turf pieces of usable size, additional sand and plant-based infill with the Owner.

END OF SECTION