

SECTION 07 33 63

SKYSCAPE™ INTENSIVE VEGETATIVE ROOF SYSTEM ELEVATE™ ROOFING, WALL, AND LINING SYSTEMS

This specification is provided as a courtesy on an as-is basis and is not intended to substitute for specific design services provided by an architect, engineer, consultant, or other design professional. It is in the building owner's interest to consult with these professionals prior to executing the specified project. The building owner will ultimately assume the entire risk as to results, quality and performance of the roofing system specified.

EDITOR NOTE: Text underlined and/or red in color must be addressed to complete a final specification document. It is the sole responsibility of the editor to exercise appropriate care and sound professional judgment in the execution of this task.

PART 1 GENERAL

The project, Project Name located in City, ST, includes the provision of a complete Elevate roofing, wall, and lining systems SkyScape™ Intensive Vegetative Roof System.

1.01 SUMMARY

- A. Furnish and install complete vegetative roof system including: **[omit components that do not apply]**
 - 1. Root barrier, **(NOTE: Not required when any thickness of Elevate UltraPly™ TPO or Elevate RubberGard™ EPDM is used as the roofing membrane. RubberGard EPDM seams must be stripped-in under the vegetative area using a bead of Elevate Pourable Sealer S-10, 1.5 inches o.c. Root barrier is required when Elevate SBS is used as roofing membrane.)**
 - 2. Drain inspection chambers,
 - 3. Drainage/water retention panel/Filter fabric,
 - 4. Growing media,
 - 5. Vegetation,
 - 6. Roof pavers,
 - 7. Edging,
 - 8. Erosion netting,
 - 9. Irrigation.
- B. The Vegetative Roof System shall be composed of a single-media system of fully integrated living and manufactured components which form a continuous cover over the designated roofing area.
- C. All components of the vegetative roof system must be provided by the roofing system manufacturer under a single, sole-sourced warranty for both roofing system and vegetative roof system.
- D. Disposal of demolition debris and construction waste is the responsibility of Contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.
- E. Comply with the published recommendations and instructions of the roofing membrane manufacturer, at www.holcimelevate.com.
- F. All conditions of the Contract and Division 1 apply to this Section.
- G. Additional requirements may be specified in other sections.
- H. Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. **No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.**

1.02 RELATED SECTIONS **[Additional requirements may be specified in other sections. Edit to suit project needs.]**

- A. Section 07 50 00 – Membrane Roofing
- B. Section 07 72 00 – Roof and Wall Accessories

- C. Section 22 00 00 – Plumbing.
- D. Section 11 01 00 – Fall Arrest Systems.
- E. Section 07 07 00 – Building Integrated Photovoltaic Systems

1.03 REFERENCES (omit all that do not apply)

- A. Referenced Standards: These standards form part of this specification only to the extent they are referenced as specification requirements.
- B. American Society for Testing and Materials International, (ASTM).
 - 1. ASTM C578-04a, Rigid Cellular Polystyrene Thermal Insulation.
 - 2. ASTM E2399-05, Standard Test Method for Maximum Media Density for Dead Load Analysis of Green Roof Systems.
 - 3. ASTM E2397-05, Standard Practice for determination of Dead Loads and Live Loads associated with Green Roof Systems.
 - 4. ASTM E2400-06 Standard Guide for Selection, Installation, and Maintenance of Plants for Green Roof Systems
 - 5. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 6. ASTM D7003-03, Standard Test Method for Strip Tensile Properties of Reinforced Geomembranes.
 - 7. ASTM D7004-03, Standard Test Method for Grab Tensile Properties of Reinforced Geomembranes.
 - 8. ASTM D4533-11, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - 9. ASTM D4533-11, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - 10. ASTM D751-06, Standard Test Methods for Coated Fabrics.
 - 11. ASTM C518-10, Standard Test Method for Steady State Thermal Transmission Properties by Means of the Heath Flow Meter Apparatus.
 - 12. ASTM D1621-10, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 - 13. ASTM C272-01, Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
 - 14. ASTM D4632-08, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - 15. ASTM D4533-11, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - 16. ASTM D4833-07, Standard Test Method for Index Puncture Resistance of Geo-membranes and Related Products.
 - 17. ASTM D6241-04(2009), Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile Related Products Using a 50 mm Probe.
 - 18. ASTM D3786/D3786M-09, Standard Test Method for Bursting Strength of Textile Fabrics Diaphragm Bursting Strength Tester Method.
 - 19. ASTM D4355-99, Standard Test Method for Deterioration of Geotextiles by Exposure to Ultraviolet Light and Water (Xenon Arc Type Apparatus).
 - 20. ASTM D4491-99a, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - 21. ASTM D4751-04, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 - 22. ASTM D5261-10, Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
 - 23. ASTM D5199-12, Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
 - 24. ASTM D5035-11, Standard Test Method for Breaking Force and Elongation of Textile Fabric (Strip Method).

- B. German Landscape Research, Development and Construction Society (Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau (FLL)).
 - 1. 2002 German FLL Guidelines for the Planning, Development, and Maintenance of Green Roofs.
- C. Occupational Safety and Health Administration (OSHA).
 - 1. Safety Data Sheets (SDS) (where applicable).

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- A. Submittals in accordance with Section 01 33 00 Submittal Procedures.
 - 1. Submit samples, Technical Information Sheets and SDS sheets of each product specified.
 - 2. Submit testing data from Penn State University Agricultural Analytical Services Laboratory. Testing should be no more than one (1) year from the date of submission.
 - 3. Submit testing data from a certified laboratory of the growing media as per ASTM E2399-05. Testing should be no more than three (3) months from the date of submission.
 - 4. Submit OSHA Safety Data Sheets in accordance with Section 01 47 for any articles for which SDS are required by OSHA.15 – Sustainable Requirements: Construction and Section 02 81 01 – Hazardous Materials.
- B. Coordinate submittal requirements and provide submittals required by Division 01 – Sustainable Requirements: Construction.
 - 1. Product Data: provide Technical Information Sheets for each product specified in the green roof assembly.
 - 2. Samples: Submit two (2) samples of each component in the vegetative roof system.
 - 3. Manufacturer’s Certificate: signed by the Vegetative Roof System Manufacturer verifying that the Installer is approved, authorized, or licensed by Manufacturer to install specified products.
 - 4. Installer’s Certificate: a letter, on company letterhead, signed by Installer verifying they have the specified qualifications described.
- C. Division 01 – Quality Control: maintenance reports.
 - 1. Reports: must be submitted quarterly, must be signed by an approved representation of Contractor/Subcontractor, and must outline actions carried out as per maintenance requirements.

1.05 QUALITY ASSURANCE

- A. Contractor/Subcontractor must have proven experience installing vegetative roof systems of a similar nature.
- B. Contractor/Subcontractor must have at least 5 years of proven experience in the application of growing media on elevated roof decks with a blower truck. (Omit when blower truck is not used)
- C. Contractor/Subcontractor must have trained staff to facilitate maintenance of vegetated roof/system. (Omit when maintenance is not included in project specification)
- D. Contractor/Subcontractor must be certified by manufacturer of vegetated roof system.
- E. All employees of Contractor/Subcontractor must maintain Fall Arrest Certificates on their person at all times while working on roof top.

1.06 QUALIFICATIONS

- A. Manufacturer: company specializing in supplying of vegetative roof systems with 5 years of experience.
- B. Preference will be given to those system providers which produce their products from local sources.
- C. Installer: company approved by membrane and vegetative roof system manufacturer.

1.07 INSPECTION AND TESTING

- A. Product test reports: based on evaluation of comprehensive tests conducted by an independent testing agency of the specified products.

- B. Manufacturer field inspection reports: Manufacturer's written acceptance of vegetative roof system installation based on manufacturer's standard inspections.
- C. (Optional) Electronic testing: perform leak testing by an electronic detection process administered by a qualified testing agency. Flood testing is unacceptable as a testing procedure. (Omit when leak detection is not part of project specification)

1.08 PERFORMANCE REQUIREMENTS

- A. Growing media must meet FLL Guidelines for extensive media.
- B. Bulk density of growing media must be less than 75 lb/ft³. Calculations must be based on maximum media density at saturation of growing media per ASTM E2399-05.
- C. Minimum dry weight of the growing media must be more than 20 lb/ft³. Calculations must be based on dry weight of growing media per ASTM E2399-05.
- D. Entire vegetative roof system must retain at least 5 US gallons/ft³ of water. Calculations must include volume of water represented by difference in weight between dry and saturated weight of the growing media per ASTM E2399-05.
- E. Growing media must have a Saturated Hydraulic Conductivity of greater than 15 inch/hour per ASTM E2399-05.
- F. All growing media must be produced within a 500-mile radius of project site.
- G. All materials involved in the making of the growing media must be from recycled products.
- H. All vegetation must be verified for compatibility by the Growing Media Manufacturer prior to acceptance.

1.09 MOCK-UP (Optional)

- A. Provide mock-up of vegetative roof system and associated components and accessories to Section 01 45 00 – Quality Control.
 - 1. Mock-up Size: 10' x 10'.
 - 2. Mock-up may remain as part of the Work.

1.10 PRE-INSTALLATION MEETINGS

- A. Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16.06 – Construction Progress Schedule – Critical Path Method (CPM).
 - 1. Meeting: prior to commencement of roof installation, review and document methods and procedures related to roof deck and roofing system construction, including:
 - 2. Participants: authorized representatives of Contractor, Construction Manager, Owner, Consultant, Roofing Subcontractor, Roofing System/Vegetative Roof System Manufacturer, and Vegetative Roof System Installer.
 - a. Review methods and procedures relating to vegetated roofing assembly, including Manufacturer's written installation instructions.
 - b. Review construction schedule and confirm availability of products, Subcontractor personnel, equipment, and facilities.
 - c. Review roofing membrane type and system for conformance with vegetated assembly criteria.
 - d. Review structural loading limitations of roof deck and identify temporary loading areas for storage.
 - e. Review flashing details, roofing details, drains, penetrations, equipment curbs, and other conditions affecting vegetated system assembly.
 - f. Review governing regulations, insurance and/or certificates where required.
 - g. Review safety requirements, including fall arrest measures.
 - h. Review field quality control procedures and review no-smoking policy.
 - i. Prior to commencement of work obtain from the EFVM Contractor a report certifying the roof is watertight.

- j. Prior to commencement of work obtain a structural report from Consultant certifying dead load weight restrictions for the entire assembly.
- k. Prior to commencement of work, ensure coordination with related work specified in other Sections.
- l. Minutes of each meeting must be taken by a representative of Consultant and distributed to all parties within 24 hours of the meeting date.
- m. Review limits of traffic by other trades on vegetated assembly and outline procedures for compensation due to damage.
- n. Review procedure for Manufacturer's inspection visit to assess compatibility with warranty requirements.
- o. Contractor must complete a photographic record of site prior to commencement.

1.11 HEALTH AND SAFETY

- A. Follow all procedures and practices listed in Section 01 35 29.06 – Health and Safety Requirements.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store Products in original packaging with Manufacturer's labels and materials list intact and signed off.
- B. Store Products in designated weather protected areas, elevated from ground, and protected from environmental damage.
- C. Avoid storage of products on site to prevent contamination.
- D. Install vegetation immediately upon delivery to site. Any necessary storage of vegetation must be in cool, dry area protected from UV exposure. Vegetation should not be stored longer than 24 hours before being installed.

1.13 SUSTAINABLE REQUIREMENTS [Edit according to needs of project]

- A. Concept Design Strategy:
 - 1. Concept Design strategy requirements detailed in Section 01 47 13 – Sustainable Requirements: Concept Design form an integral part of this project including materials and products of this Section. Sustainable design concepts include:
 - a. Holistic green design framework.
 - b. Descriptions of design criteria.
 - c. Setting sustainable goals based on projects design decisions.
- B. Sustainability goals are delineated with measurable performance targets.
- C. Operational requirements are specified to transform design requirements into physical (site and building) requirements.
- D. Construction:
 - 1. Construction requirements detailed in Section 01 47 15 – Sustainable Requirements: Construction form an integral part of this project including materials and products of this Section. Sustainable construction requirements include:
 - a. Specific construction requirements for project.
 - b. Administrative, temporary, and procedural requirements for the use of materials and methods of construction.
- E. Verification:
 - 1. Contractor's verification established in Section 01 47 17 – Sustainable Requirements: Contractor's Verification form an integral part of this project. Verification requirements include:
 - a. Verification of performance requirements and expected results included in Concept Design and specified in Section 01 47 15 – Sustainable Requirements: Construction.
 - b. Compliance with sustainable requirements specific to this technical section.

- F. Operation:
 - 1. Operation requirements specified in Section 01 47 19 – Sustainable Requirements: Operation form an integral part of this project. Operation requirements include:
 - a. Products, materials, services, and methods used in operation and maintenance of building consistent with procurement policy of eco- purchasing that reduces volume of wastes, material costs, toxicity of products and supports recycling.

1.14 ENVIRONMENTAL REQUIREMENTS

- A. Vegetation must be installed according to optimal conditions, conducive to plant establishment and survival.
- B. All other components and growing media may be installed at any time provided adequate protection is provided to prevent damage and erosion.
- C. Traffic is prohibited on vegetated assembly during the establishment period.

1.15 MAINTENANCE

- A. Maintenance: conducted annually in accordance with this specification for entire warranty period.
- B. Initial maintenance: include weekly inspection of entire green roof for the first eight (8) weeks, providing irrigation as required to ensure survival of new plantings. Conduct bi-weekly inspection for further eight (8) visits, including irrigation, re-planting and weeding out of non-intended plantings as required.
- C. Regular maintenance: commence following initial maintenance period. Visit site month during each active growing season. This schedule includes removal of unintended species, replacement of dead plantings, plant-appropriate pruning, cleaning of drains and maintenance free areas, programming and opening/closing of irrigation system, watering, repair or replacement of components due to normal wear and tear as required.
- D. The following products are to be used, as required, in order to maintain the performance parameters of the vegetated system:
 - 1. Aerobic compost tea by a supplier certified by Growing Media Manufacturer
 - 2. Kelp meal.
 - 3. Pelletized compose or alfalfa.
 - 4. Fish emulsion.
 - 5. Micro-blend™.
- E. All products in the maintenance of the green roof must be certified organic and approved by Vegetative Roof System Supplier. Use of chemical fertilizers or pesticides is strictly prohibited.

1.16 SUBSTITUTION PROCEDURES

- A. Submit requests for alternates to this specification a minimum of fifteen (15) working days prior to bid closing for evaluation in accordance with [\[Section XXXXXX\]](#).
 - 1. Submit evidence that alternate materials meet or exceed performance characteristics as set out in this specification.
 - 2. Submit documentation from an approved independent testing laboratory certifying the performance of vegetated roof system and its components in accordance with testing methods cited in Part 1.8 Inspection and Testing of this section.
 - 3. Submit references clearly indicating that Vegetative Roof Installer has successfully completed projects on an annual basis of similar scope and nature for a minimum of five (5) years.
 - 4. Submit Manufacturer's complete set of standard details for extensive vegetative roof system.
 - 5. Submit a list of five (5) projects executed over the past twelve months and any related case studies.

1.17 WARRANTY

- A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.
- B. Warranty: Provide Elevate SkyScape™ Limited Warranty Rider to Elevate Red Shield™

Warranty, plants, irrigation system (if applicable), and other manufacturer provided system accessories.

1. Materials: Filter layer, retention layer, drainage layer, root barrier, and/or slip sheet, will not deteriorate to the point of failure due to weathering. Plants properly installed in Elevate-provided engineered growth medium will cover no less than 80% of their original installed coverage area for a period of thirty (30) days from the date of installation.
2. Overburden: Provide for the removal and replacement of System components as necessary to expose the system for inspection and/or repair of leaks in a roofing system.
3. 24-Month Plant Coverage: If the system vegetation does not cover at least 50% of the garden roof area twelve (12) months from the date of installation, and at least 80% of the garden roof area twenty-four (24) months from the date of installation, manufacturer will take such steps to restore plant coverage to the stated percentages.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Manufacturer of vegetated roof system having systems and/or products approved for use:
 1. SkyScape Intensive Vegetative Roofing System by Elevate roofing, wall, and lining systems, www.holcimelevate.com.

2.02 MATERIALS

- A. Root Barrier: (optional, see note in Part 1.4.1.A)
 1. Material: Heavy duty reinforced polymer film, 10 mil thick, three-ply laminate with high strength cord grid, flame-retardant.
 2. Flame Spread Index-Class A ASTM E84: 5
 3. 1" Tensile Strength ASTM D7003: 50 lb/ft
 4. Elongation at break ASTM D7003: 600%
 5. Grab Tensile Strength ASTM D7004: 78 lb/ft
 6. Trapezoid Tear ASTM D4533: 52 lb/ft
 7. Hydrostatic Resistance ASTM D751: 74 psi
 8. Mullen Burst ASTM D751: 169 psi
 9. Product approved for use: SkyScape Root Barrier by Elevate Building Products.
 - a. Accessory: SkyScape Root Barrier Tape by Elevate Building Products.
- B. Drainage Panel: A composite drainage system consisting of 100% postindustrial polystyrene regrind dimple core and two layers of geo-synthetic fabric attached top and bottom. It should meet the following properties:
 1. DRAINAGE CORE:
 - a. Compressive Strength (psf): ASTM D-1621 9,500 psf
 - b. Thickness (in.): ASTM D-1777 1.0 in
 - c. Flow (ASTM-D4716) 30 gal/min/ft
 - d. Hydraulic Gradient = 1 372 l/min/m
 2. ROOT RESISTANT FABRIC
 - a. Basis Weight (oz): ASTM-D3776 100 gsm
 - b. Grab Tensile (lbs/inch): ASTM-D4632 75 lbs
 - c. Grab Elongation (%): ASTM-D4632 40%
 - d. Trapezoidal Tear (lbs.): ASTM-D4533 20 lbs
 3. GEOTEXTILE:
 - a. Mass/unit area (oz/y²): ASTM D-5261 4.0 oz/ y²
 - b. Grab tensile strength (lbs.): ASTM D-4632 90 lbs.
 - c. Puncture (lbs.): ASTM D-4833 40 lbs
 4. WATER RETENTION:
 - a. Capacity (gallons/sf): ASTM E-2398-05 1.1 gal/ft²
 5. Product approved for use: SkyScape Drainage Panel 1.0" by Elevate.
- B. Filter Fabric:

1. Physical Properties:
 - a. Basis Weight (oz): 3.3 oz
 - b. Grab Tensile (lbs/inch): ASTM D-4632 MD 54.2 lbs/inch CD 47
 - c. Grab Elongation (%): ASTM D-4632 MD 54% CD 78
 - d. Trapezoidal Tear (lbs.): ASTM D-4533 MD 26.2 lbs. CD 19.9
 - e. Adhesive bonding core material to geotextile: Pressure sensitive applied to core.
2. Product approved for use: SkyScape Filter Fabric by Elevate.
- C. Growing Medium:
 1. Intensive Lightweight Soil Mix for On-Structure Planting Areas.
 2. Product approved for use: SkyScape Intensive Growing Media by Elevate.

2.02 INTENSIVE VEGETATIVE ROOF SYSTEM

- A. Description:
 1. This work shall consist of preparing a lightweight, free draining soil containing all the physical, chemical, and biological properties to create a sustainable landscape. This mix will be pre-blended offsite and delivered ready for installation.
 2. Media depth: (_____) inches.
- B. Materials (component specifications):
 1. The materials will consist of the components listed below which must meet the corresponding testing standards for each component.

Property	Test Method	Value	Performance
3/8" – 3/16" Hydrocks Rotary Kiln Expanded Clay	ASTM C 29	Dry Loose Unit Weight	28lbs/ft ³ to 34lbs/ft ³
	ASTM C 127	Specific Gravity	1.12 to 1.20, SSD
	ASTM C 127	Absorption	25% to 33%
	ASTM C 136	Sieve Analysis	#3/8 to 0
Plant Nutrients	TMECC 4.02D	Nitrogen	>1.2% dry weight
	TMECC – Calculation	Phosphorus	>0.50% dry weight
	TMECC – Calculation	Potassium	>0.50% dry weight
	TMECC 4.05	Calcium	>0.90% dry weight
	TMECC 4.05	Magnesium	>0.20% dry weight
	TMECC 5.07-A	Organic Matter Content	>50% dry weight
Soluble Salts	TMECC 4.08-A	dS/m (mmhos/cm)	<4.0
Particle Size	TMECC 2.02-B	% under 9.5mm	95% or greater
Stability Indicator (respirometry)	TMECC 5.08-F777	CO2 Evolution (mg CO2-C/g OM/day)	<2
Maturity Indicator (bioassay)	TMECC 5.05-A	Percent Emergence	85% or greater
		Relative Seedling Vigor	85% or greater
Select Pathogens	US EPA Class A, 40 CFR 503.32(a)	Pass/Fail	Pass
USGA Sand (5-30% by volume)	Sand Component	Particle Diameter	Recommendation (by weight)
	Fine Gravel	2.0-3.4 mm	Not more than 3%
	Very Coarse Sand	1.0-2.0mm	Not more than 10%
	Coarse Sand	0.5-1.0mm	Minimum 60% Total Coarse-Medium
	Medium Sand	0.25-0.50mm	
Fine Sand	0.15-0.25mm	Not more than 20%	
Property	Test Method	Value	Performance
Maximum Acceptable Weights	ASTM E 2399	Saturated Density	Loose = 76pcf wet weight, Rodded = 82pcf wet weight

		Drained Density	Loose = 42pcf wet weight Rodded = 51psf wet weight
Permeability	ASTM D 2434	Inches per hour	40in/hr or greater
Organic Matter	N/A	N/A	4.0% rate or better
Soil pH	N/A	N/A	6.0 – 7.0
Cation Exchange Capacity	N/A	N/A	7.5 or better
Estimated Nitrogen Release	N/A	N/A	Medium or higher as tested by soil analysis
Potassium	N/A	N/A	Medium or higher as tested by soil analysis
Magnesium	N/A	N/A	Medium or higher as tested by soil analysis
Calcium	N/A	N/A	Medium or higher as tested by soil analysis

C. Vegetation: ([select all that apply])

1. Plug plants are to be provided in (50-, 72-) plug tray with well-established rooting.
2. Spacing: (6-, 8-, 9-, 10-, ____) inches on center.
3. Product approved for use: SkyScape Plant Plugs by Elevate.

[AND/OR]

D. Cuttings are to be provided in bulk bags.

1. Spread Rate: (5 lb, 10 lb) /100 ft²
2. Product approved for use: SkyScape Sedum Cuttings by Elevate.

[AND/OR]

E. Pre-grown sedum mats

1. Three-dimensional filament mat pre-grown with succulent vegetation and growing media to form a cohesive vegetated blanket.
2. Species contained in mat are as follows: Sedum spurium 'Fuldaglut'; Sedum spurium 'John Creech'; Sedum spurium 'Red Carpet'; Sedum spurium 'Tricolor'; Phedimus kamtschaticum; Phedimus takesimensis 'Golden Carpet'; Sedum acre 'Gold Moss'; Sedum album 'Coral Carpet'; Sedum album 'Murale'; Sedum floriferum 'Weihenstephaner Gold'; Sedum reflexum 'Blue Spruce' Sedum rupestre 'Angelina'; Sedum sexangulare; Sedum x Immergrunchen
3. Product approved for use: SkyScape Sedum Mats by Elevate.

[AND/OR]

F. Custom and/or Native Plants

1. Custom and/or native plants per list provided in construction drawings.
2. Product approved for use: custom plants purchased through Elevate.

2.03 ACCESSORIES

A. Drain Inspection Chambers:

1. Material: aluminum, form bent from solid sheet.
2. Must be perforated at the drainage course level to allow for free drainage and
3. solid at the growing layer to prevent rooting and plant growth through the edging.
4. Height: 1" higher than the finished growing medium height.
5. Shape: box-shaped, with a solid lid fitted with locking mechanisms.
6. Total exterior dimensions: 15" x 15" x 6"
7. Product approved for use: SkyScape Aluminum Drainage Inspection Chamber by Elevate.

B. Edging:

1. Material: extruded aluminum edging.

2. Must be perforated at the drainage course level to allow for free drainage and solid at the growing layer to prevent rooting and plant growth through the edging.
 3. Shape: L-Shaped
 4. Drainage hole radius: $\frac{3}{4}$ ".
 5. Product approved for use: SkyScape Edge Flashing by Elevate.
- C. Tape:
1. Material: Film backing lined with acrylic adhesive.
 2. Self-adhered, waterproof flashing membrane with acrylic pressure sensitive adhesive.
 3. Temperature tolerant and adheres to damp surfaces.
 4. 2-inch-wide x 75 ft roll.
 5. Product approved for use: SkyScape Root Barrier Tape by Elevate.
- D. Irrigation:
1. Sprinklers:
 - a. Sprinkler bodies must be Schedule 80. Add extensions as required to accommodate plantings.
 - b. Sprinkler nozzles must be rotary-type and inserted into the sprinkler bodies as per system supplier's literature and instructions. Add extensions as required to accommodate plantings
 - c. Products approved for use: Hunter PS bodies and MP Rotator nozzles
 2. Pipe:
 - a. All pipes must be continuously and permanently marked with the following information: Manufacturer's name or trademark, size, schedule and type of pipe, working pressure at 72 degrees F. Polyethylene pipe: $\frac{3}{4}$ " or larger and be of high, medium or low density with a minimum pressure rating of 75 psi. All polyethylene pipe should be a minimum schedule 40-standard.
 - b. P.V.C. pipe: class 160, SDR 26 direct burial pipe conforming to CS -256-63 and homogeneous throughout and free from visible cracks, dents, holes, or foreign materials. All plastic pipe fittings to be installed shall be schedule 40 molded fittings manufactured for the same material as the pipe and shall be suitable for solvent weld, slip joint ring tight seal, or screwed connections. No fittings made of other material shall be used except brass saddle tees and crosses as hereinafter specified. Slip fitting socket taper shall be so sized that a dry pipe end, conforming to these special provisions, can be inserted no more than halfway into the socket. All threaded connections under pressure should be Teflon taped or an equivalent substitute. Compressive strength ASTM D1621: 40 psi.
 3. Automatic control valves:
 - a. All automatic valves: of current design and manufacturing date, and 24v electric solenoid or hydraulically controller. Material: P.V.C. plastic, or brass construction featuring slow opening and closing operation, with
 - b. a manual bleed device.
 - c. All manual and automatic valves: enclosed in thermo plastic boxes with covers, of size as required to permit "ease of access" for service purposes. The term "ease of access" means that every solenoid and manual valve should have adequate access for all types of maintenance. All valve
 - d. access boxes: installed on a suitable base for stability and drainage.
 - e. Products recommended for use: Hunter PGV Series or Rainbird JTV Series.
 4. Automatic controllers:

- a. All automatic irrigation controllers: of current design and manufacturing date by a name brand manufacturer or irrigation supplier. They may be of solid state or electro-mechanical construction, to operate from a conventional 115 v service.
 - b. Minimum features that the unit offers:
 - c. Four stations of independent duration settings,
 - d. 24-hour clock,
 - e. Rainy weather shutdown mode,
 - f. Seven- or fourteen-day calendar cycle,
 - g. Master valve or pump start circuit,
 - h. Products recommended for use: Hunter or Rainbird Automatic Controllers.
5. Wiring:
- a. All 115-v wiring: conform to local electrical codes.
 - b. All 24-v control wire between solenoid valves and controllers: Number 14-gauge TWU-40o solid conductor, white jacket for the common wire, and colored for the power wire. For runs less than 500', and single valve operation: Number 16, Number 18, Number 20 gauge multi-colored and conductor wire may be used. If two controllers are used, each unit must have its own common wire.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces and report any adverse conditions which may negatively impact appearance or performance of vegetated roof system. Ensure all unacceptable conditions are corrected before proceeding.
- B. Ensure adequate provisions have been made for loading, unloading, storage, parking, and access to roof site.
- C. Execute work in accordance with the specification, drawings, and details.
- D. Report any imbedded object or obvious damage to Consultant.
- E. Ensure all equipment is in good working order. Protect all equipment which comes into contact with roofing membrane, flashings, and related work.
- F. Ensure adequate safety equipment has been obtained for all operations.

3.02 SYSTEM INSTALLATION

- A. Root Barrier:
 - 1. Install root barrier continually over finished membrane surface, including all vertical surfaces and projections.
 - 2. Overlap and seal with Manufacturer's tape all side and end laps a minimum of 4" and allow for root barrier to reach up all verticals 1" above the intended soil line and secure.
- B. Edge Flashing:
 - 1. Install edging along perimeter border between vegetation-free area and vegetated area.
 - 2. Ensure base flange is pointed towards the vegetated areas.
 - 3. Make sure edging includes 2" adhesive strip along top of edge, below lip, to accept filter fabric.
 - 4. Secure edge of foot-wide filter fabric trim to edging surface.
- C. Drainage Panels:
 - 1. Lay retention/drainage board panels over insulation up to vertical edging.
 - 2. Cut tightly around any projections, drains, etc.
- D. Inspection Chambers:
 - 1. Install inspection chamber centered over drains directly on the insulation board. Ensure the bottom inner edge of the chamber is outside of the outer edge of the drain flange.
 - 2. Install vertical drains around outside of inspection chamber.

3. Install filter fabric over vertical drains and over lip of inspection chamber.
 4. Cut slits in fabric to fit around locking pins and adhere to top inside edge with Manufacturer's tape.
- E. Irrigation Lines and Sprinkler Bodies
1. Lay lateral lines per zone as per irrigation drawings.
 2. Install sprinkler bodies in locations as per irrigation drawings.
 3. Install main lines, valves, valve boxes and controller wires in accordance with irrigation drawings.
- F. Growing Media:
1. Blower Truck: Growing media must be installed using a truck-mounted, integrated, pneumatic blower unit. In order to ensure accuracy, the unit should be powered by its own separate diesel power unit, not PTO driven, and equipped with at least one computer-controlled supplemental granular injection system.
 - a. The unit must be capable of uniformly applying materials and injected products at a rate greater than 15 yd³/hour at least to a vertical limit of 150' and must also be equipped with an application hose capable of extending 300' from the blower truck.
 2. Super Sacks
 - a. Crane sacks to approximately 4-5' above roof surface. Cut sacks on the underside and allow media to deposit slowly onto drainage panels. For sacks with built-in nozzles, open nozzle end and allow media to deposit slowly onto drainage panels.
- G. Vegetation:
1. Plant Plugs, Custom Plants, Native Plants:
 - a. Where plug plants are used, dig a hole in excess of the size of the root ball after extracting it from the pot. Cover root ball, ensure plants are planted to their full root depth and gently tamp in place.
 - b. Mulch may be applied 1-2" deep as a protective layer and to assist with moisture retention.
- [AND/OR]
2. Sedum Cuttings:
 - a. Spread cuttings over growth media at the prescribed rate. Water thoroughly.
- [AND/OR]
3. Pre-grown sedum mats:
 - a. Lay pre-vegetated mats over the growing media, ensuring edges are firmly butted together.
 - b. Trim to fit neatly around projections and edges.
 - c. Dispose of excess mat.

3.03 FIELD QUALITY CONTROL

- A. Contractor/Subcontractor must have 5 years proven experience installing vegetative roof systems of a similar nature, or must have on-roof supervision by Manufacturer's representative.
- B. Contractor/Subcontractor must have trained staff to facilitate maintenance of vegetative roof system.
- C. Contractor/Subcontractor must be certified by manufacturer of vegetated roof system.
- D. All employees of Contractor/Subcontractor must maintain Fall Arrest Certificates on their person at all times while working on roof top.
- E. Require site attendance of roofing materials manufacturer's representative during installation of Work.
- F. Field quality control is under control of Contractor. Field quality assurance is monitored by [Departmental Representative] [Consultant] [independent inspection].

- G. Inspection and testing of roofing application through electronic field vector mapping will be carried out by [Departmental Representative] [Consultant].
- H. [Departmental Representative] [Consultant] will pay for tests as specified in Section [01 45 00 Quality Control].
- I. Correct identified defects or irregularities.

3.04 VERIFICATION

- A. Verification requirements in accordance with Section [01 47 17 – Sustainable Requirements: Contractor's Verification], include:
 - 1. Materials and resources. Storage and collection of recyclables.
 - 2. Construction waste management.
 - 3. Resource reuse.
 - 4. Recycled content.
 - 5. Local/regional materials.
 - 6. Low-emitting materials.

3.05 OPERATION REQUIREMENTS

- A. Operational requirements in accordance with Section 01 47 19 – Sustainable Requirements: Operation, include:
 - 1. Cleaning materials and schedules.
 - 2. Repair and maintenance materials and instructions.

3.06 CLEANING

- A. Gather and dispose all debris upon completion of work of this section.
- B. Clean all surfaces and inspect final assembly for approval.

3.07 REPORTS

- A. Submit maintenance reports quarterly to Owner and Vegetative Roof System Manufacturer (to maintain warranty).
- B. Maintenance reports must be signed by an approved representative of Contractor and/or Subcontractor.
- C. Maintenance reports must outline actions carried out in accordance with maintenance requirements of this specification, as well as dates, personnel at each visit and notes on growing conditions.
- D. Subcontractor not conforming to the above maintenance requirements will be replaced, however, will still be held responsible for the results and costs of the replacement Subcontractor.

END OF SECTION