

The University of Virginia

VEGETATED ROOF STANDARDS



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VEGETATED ROOF GUIDELINES



The University encourages the incorporation of vegetated roofs, both intensive and extensive, new and retrofit, into its structures for the benefit of reduced heat island effect, stormwater management, thermal properties, habitat, aesthetics and viable outdoor spaces. However, the University expects certain infrastructure to be provided in order to ensure the successful functioning of the vegetated system, while recognizing these are living systems that evolve over time. In addition, design and maintenance objectives for the roof must be vetted with the appropriate University representative and the roof design developed accordingly.

GENERAL REQUIREMENTS



- Vegetated roofs will be designed and detailed by an experienced vegetated roofing consultant. This roofing consultant will be a member of the design team from the beginning of a project's design.
- A thorough maintenance manual shall be developed by the vegetated roofing consultant for all vegetated roof projects. The maintenance manual will be written in support of the design and maintenance objectives developed for the roof and will address installation, establishment and post establishment periods and provide guidance on issues such as irrigation, media testing, fertilization, weed management and roof element inspection.
- A two year maintenance agreement will be provided for all vegetated roof projects. At the end of this period, an on site meeting will be scheduled between the contractor and UVA Landscape to review maintenance as recommended in the maintenance manual.
- All vegetated roofs will provide reasonable and safe access for landscape maintenance personnel, and must be approved by University Landscape Superintendent.
- Vegetated roof design will provide access to roof top equipment such as drains, sky lights, etc., such that frequent foot traffic over planted areas is avoided.
- Vegetated roofs should only be considered for building projects where a minimum of 1,000+/- SF of contiguous vegetated roof can be accommodated unless part of a demonstration project accessible to the public.
- Warranty:
 - Single-source, full assembly green roof system replacement in the event of membrane failure to include membrane plus all overburden, including soil medium and plant replacement required for a minimum of 20 years.
 - For plugs, 50% vigorous plant coverage warranty in 1 year and 80% vigorous plant coverage in two years.

INSTALLATION



- Installation shall only be done by qualified, certified, experienced vegetated roof installers.
- Waterproofing membrane to be water-tested, witnessed, confirmed in writing and approved by University prior to installation of any over burden of green roof system components.
- Before installing waterproofing membrane, the vegetated roof system contractor and other appropriate parties shall visually inspect the substrate surface to verify it is clean, dry, smooth and acceptable for vegetated roof membrane and system installation.
- Vegetated Roofing Consultant to inspect and approve installation of vegetated roof system, including all layers, and submit approval to University Roofing Project Manager.
- UV or temperature sensitive roofing materials to be protected prior to and during vegetated roof installation.
- Installation will be coordinated by contractor such that trades other than the vegetated roof installer have limited and managed access to the area receiving the vegetated roof to avoid damage to waterproofing membrane.
- Vegetated roofs (accepting pre-grown trays and carpets) shall be planted in appropriate season. Sedum pots shall be planted March-April-May, or in fall if acceptable to Landscape Superintendent. Pre-grown trays and carpets cannot be installed in freezing temperatures. Sedum carpets must be installed immediately upon arrival at project site.
- Stockpiled growth media to be covered or otherwise protected from weed seed contamination.

WATER-PROOFING AND LEAK DETECTION



- Liquid applied rubberized asphalt (minimum 25% recycled content), applied in two layers with nominal 215 mils minimum thickness fabric reinforcement between layers
- Other fully adhered membrane systems if acceptable to University Roofing Project Manager, Code Review Official and University Architect.
- Provide electric field vector mapping leak detection systems, where required by Roofing Project Manager and Facilities Management for vegetative roof systems. Components of vegetated roof system, including membrane, must be compatible with electric field vector mapping leak detection system.



- Any fertilizers, chemicals and pesticides must be compatible with roof waterproofing membrane system and in compliance with University nutrient management plan.
- Weeding must be performed 3-4 times/year min. during the growing season and scheduled to remove plants before seeds set. During establishment, vegetation should be inspected weekly for tree seedlings and invasive/undesired plants. Designated vegetation free zones to be kept clear.
- Irrigation systems to be checked weekly during the growing season for proper performance and activated as necessary for establishment and plant health.
- Follow maintenance manual for irrigation for establishment and beyond. Moisture levels of growth media to be inspected during hot, dry periods and supplemental watering provided if necessary.
- Engineered growth medium to be laboratory tested yearly for pH, salts and nutrients, or in the event of poor plant growth. Sedum plantings require a pH range between 6-8; growth medium should be tested yearly for pH range due to acid rain; and appropriate corrective actions taken.
- Inspect for wind or water erosion 1-2 times/year and take corrective action as necessary.
- Remove excess biomass such as leaves and spent seedheads to protect against fire hazard.
- Inspect plants for health/performance several times during the growing season; supplemental planting with plugs may be necessary for areas where plants are performing poorly.
- Inspect and clear scuppers and drains two times minimum per year.

VEGETATED ROOF SYSTEM TYPES and CATEGORIES

1) Modular tray extensive- 1'x2' , with interlocking capability, depth to support a minimum of 4" of engineered growth media, made from recycled content, with positive drainage cells and designed such that growth media covers tray edges by 1" depth. Trays shall be pre-grown for 1 growing season minimum. Trays set on slip sheet/root barrier of 45-60 mil. with bonded seams; material compatible with roofing membrane system. Exposed tray edges to be protected with sturdy, aluminum "L" shaped edging, 4.5"x3"+/-.

2) Integral vegetated roof designed as a comprehensive assembly including fully-adhered waterproofing membrane, moisture resistant insulation, protection course/root barrier, drainage layer and, filter fabric, engineered growth medium (4" depth minimum) and plants.

Extensive Roof Systems

| Garrett Hall



Semi-Intensive Roof Systems

| Garrett Hall



Intensive Roof Systems

| Carter Harrison



| Medical Research Building



| Medical Research Building



| Special Collections

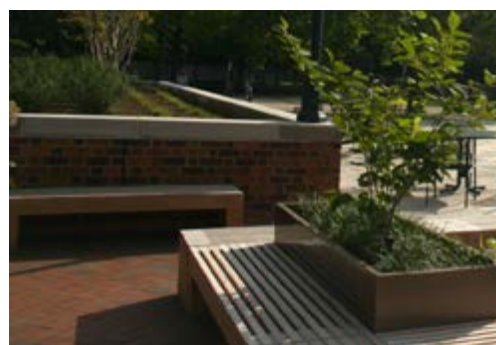


Rooftop Planters

| Rouss Robertson



| Newcomb Hall



| Rouss Robertson





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EXTENSIVE VEGETATED ROOF SYSTEMS

- Shallow depth that supports largely sedum species, typically 4"-6"

- Engineered Growth Medium:

Design and specify according to depth of medium and types of plants to be used; consult manufacturer or experienced consultant; meet German FLL requirements for engineered growth medium and submit certified laboratory tests for approval.

Extensive, typical range: 60-100% expanded slate or clay; 0-35% coarse sand; 0-25% organic material (compost)

- Plant Selection:

Primarily sedum of mixed variety and with a majority of sedums displaying year-round interest. Select species for shade tolerance where appropriate given roof's exposure. Sedum installed as plugs, 2 1/4" pots or blanket reinforced with biodegradable netting. Species and sizes to be approved by University Landscape Architect and Landscape Superintendent.

- Irrigation:

- Extensive vegetated roofs will have, as a minimum, a hosebib provided for irrigation during establishment and dry periods. Other temporary forms of irrigation must be acceptable to Landscape Superintendent.
- Provide permanent irrigation for high-visibility extensive vegetated roofs, type to be determined and approved by Landscape Superintendent.
- Irrigation shall tap non-potable sources such as condensate or stormwater cisterns.
- Irrigation piping material to be stainless steel or PVC schedule 40. Galvanized & copper piping not acceptable due to potential leakage damage to plants.



The extensive vegetated roof at Garrett Hall was a retrofit project done with the renovation of the building to house the Frank Batton Shool of Leadership and Public Policy. The roof is above a later addition to historic Garrett Hall that previously housed computer server equipment. The rooftop prior to renovation consisted of concrete paving. Now, the rooftop has been transformed into a vegetated roof with a patio to accommodate a seating area; new skylights provide daylight to the areas below. The vegetated roof has 4" deep growth media layer and is planted with a mix of sedum varieties that provide an array of color and texture year round. Initially, the sedum were planted with plugs, but these were damaged by punch-list foot traffic and the University decided it did not wish to wait the number of years required for plugs to infill, and so these were replaced with sedum carpet tiles. Irrigation is provided via a non-potable source- a cistern that collects run-off from the building roof and impervious site surfaces.



The extensive roof at Medical Research building #5 is an example of a tray system. 4" deep LiveRoof trays pregrown with a mix of sedum varieties were used on this vegetative roof retrofit. Originally, this roof was covered in 12"-18" of typical garden topsoil, installed at a time before the practices of vegetated roofs were well established. Of course today, such roofs use a light-weight, well-draining growth media that does not trap water over the roof membrane. Due to repairs of a number of roof membrane leaks, this heavy topsoil was removed and replaced with lightweight aggregate. Not wanting to leave this very visible section of roof in aggregate only, the University installed LiveRoof trays over top of the aggregate. LiveRoof trays are designed with positive drainage so that the sedums do not drown; furthermore, the trays snap together for stability and have 1" of growth media over the tray edges so that the tray edges are not exposed to UV rays.



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SEMI-INTENSIVE VEGETATED ROOF SYSTEMS

- Moderate depth capable of supporting lawn, ornamental grasses and some shrubs, typically 12"-15"
- Plant Selection:
Sod turf grass and low-maintenance grasses and perennials adapted to green roof engineered growth medium. Minimum plant installation size 4" container; 1 gallon recommended for woody plants.
- Irrigation:
 - Intensive or semi-intensive vegetated roofs will have sub-surface automatic drip systems with moisture sensor controls.
 - Irrigation shall tap non-potable sources such as condensate or stormwater cisterns.
 - Irrigation piping material to be stainless steel or PVC schedule 40. Galvanized & copper piping not acceptable due to potential leakage damage to plants.



A section of semi-intensive roof also exists at Garrett Hall; it is immediately adjacent to the extensive sedum section and is also a retrofit. This section of roof, however, was not paved in concrete but consisted of soil and mulch. As this roof membrane has been protected by the soil, no replacement was necessary. But the project wished to make this section of roof more attractive and accessible, so it was planted with low-maintenance ornamental grasses and sedum varieties. Bluestone paths, path lighting and benches were added to create a rooftop garden for the University community.



In addition to the LiveRoof sedum trays, a section of vegetated roof of moderate depth supports bands of ornamental shrubs. The soil used on this section of roof was a typical topsoil garden mix, specified prior to the standards for vegetated roof growing media were established. Since this area of the roof is currently not experiencing leaks, the University decided to maintain this area of soil rather than risk damaging the membrane. However, the soil is heavy and the original shrubs suffered from too much moisture. Shrubs more tolerant of heavy but shallow soils were selected to replace the original shrubs, red sprite winterberry and yellow twig dogwood.



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INTENSIVE VEGETATED ROOF SYSTEMS

- Deep, capable of supporting shrubs and small to large trees, typically 18"-36" deep
- Engineered Growth Medium:
Design and specify according to depth of medium and types of plants to be used; consult manufacturer or experienced consultant; meet German FLL requirements for engineered growth medium and submit certified laboratory tests for approval.
Intensive, typical range: 35-60% expanded slate or clay; 25-50% coarse sand; 5-20% organic material (compost)
- Plant Selection:
Shrubs, trees and ground covers adapted to roof microclimates and green roof engineered growth medium; typical landscape installation sizes.
- Irrigation:
 - Intensive or semi-intensive vegetated roofs will have sub-surface automatic drip systems with moisture sensor controls.
 - Irrigation shall tap non-potable sources such as condensate or stormwater cisterns.
 - Irrigation piping material to be stainless steel or PVC schedule 40. Galvanized & copper piping not acceptable due to potential leakage damage to plants.



The Carter-Harrison building is a research and laboratory facility and includes a large intensive vegetated roof that serves a courtyard surrounded by other research buildings. It consists of a central quadrangle of lawn, with brick pathways and perimeter plantings of small ornamental trees, shrubs and groundcovers. An herb garden featuring different types of perennials with medicinal significance occupies one side of the quadrangle. Beneath this quadrangle are research labs. When this project was originally designed, the industry standards for growth media were not widely known in the United States, and the drawings specified normal garden topsoil. The drawings were shelved and the project postponed until a time that funding was available. Fortunately, the soil spec was revisited and a properly draining growth media specification was used.



The fact that the Special Collections quadrangle is a vegetated roof is not apparent, as it is at-grade with the surrounding landscape. However, much of the quadrangle exists over underground library space. The roof landscape consists of lawn panels, brick walks, seating areas and raised and at-grade planters. Skylights set within the raised planters allow light to penetrate into the library space below. The lawn areas and beds are irrigated, although some plants are healthier than others. For example, rosemary, which is very tolerant of well-draining soils, has performed very well here. Dwarf nandina, which is normally a very durable and tough plant, has done less well. Due to the irrigation and well-drained soil, the lawn has been consistently healthy, except in times of water restrictions due to drought.

Although not considered a vegetative roof, independent planters can provide a means to support plants on a rooftop and can be effective on existing roof enhancements or retrofits where a vegetative roof is not feasible. However, in order to successfully support the intended vegetation, thoughtful consideration must be given to planter selection, size and maintenance requirements. Like intensive vegetated roofs, planters require irrigation, either a traditional irrigation system or manual-fill irrigation reservoirs. Planters must be of the appropriate size to support the intended vegetation. Rooftop planters will not be large enough to accommodate shade trees; however, sizes do exist large enough to support large shrubs, small trees or even bamboo and these plants can provide a certain amount of shade. Adequate structural support must exist to carry the weight of the planter- either column or beam supports. Like vegetated roofs, planter growth media mix must be well-draining. Plants must be selected that are suited to growing in these types of mixes and that can tolerate the unique microclimates of a rooftop.



Rooftop terraces with integral intensive planters are a form of vegetated roof, designed with the building in order to assure adequate structural support. Such roofs typically contain more paved areas for seating or gathering. Integral planters should be designed to provide sufficient growth media quantities for the perennials, shrubs and/or small trees that they will contain. As with all intensive systems, irrigation is required, as the growth media is designed to be well-draining and the plant palette is typically ornamental. Although large shade trees are not typically accommodated on a rooftop terrace, trellises planted with vines can provide shade for seating or gathering areas.



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MAP OF EXISTING VEGETATED ROOFS

