GREEN ROOF HANDBOOK

Systems and Components for Optimal-Performance Green Roofs







INTRODUCTION

HISTORY: Conservation Technology green roof components have built thousands of green roofs throughout North America for more than thirty years. Our first project, an intensive green roof in the middle of Baltimore City, has been producing vegetables and herbs continuously since 1981 (photo at right).

OPTIMAL COMPONENTS: Every component we supply is optimized for green roofs. Our geotextiles are the result of several years of development and testing, not generic products that have been re-purposed. Our aluminum edge is probably the strongest in our industry and offers unique design features to enhance drainage and simplify installation. Our sheet drains are thicker than others and are precision made. While this quality makes our products a little more expensive than others, the cost differential typically only represents a few percent of the total green roof capital cost and over the life of the roof our products can yield significant savings in maintenance.



OPTIMAL SYSTEMS: We don't just sell individual components: we provide green roof professionals with complete system solutions with all required components along with technical support to assure the best solution for each project. We have systems for roofs that are dead level or steeply sloped, for tiny residential roofs or huge commercial projects, and for existing roofs with minimal load capacity or new roofs with unlimited capacity. We know how to design sedum roofs or elevated forests, natural meadows or highly structured landscapes, rooftop gardens or lawns, as well as plaza roofs or photovoltaic roofs.

OPTIMAL WATER MANAGEMENT: We can determine the best green roof system based on rainfall availability, roof slopes and drains, irrigation requirements, and stormwater runoff goals. Proper drainage assures a healthy green roof and preserves the building, but too much drainage robs the green roof of water and leads to unnecessary irrigation. Our components and systems can fine tune water retention and runoff rates to meet any requirement. We can even design zero runoff systems that capture all of the yearly rainfall and recycle it for irrigation.

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System Chart back cover



GREEN ROOF SYSTEMS

Conservation Technology green roof systems can be functionally categorized by drainage type (P, G, or M) and nominal thickness (1, 2, 3, or 4). The combination of these factors (P1, M2, G4, etc) defines the structural load, the allowable slope, the type of vegetation supported, and the rainwater retention characteristics.

DRAINAGE TYPE: Drainage Type P utilizes drainage plates, waffled plastic sheets that store water above and drain water below. Drainage plates are lightweight, are easy to install, and are available in different heights to meet the drainage and water storage requirements of almost any green roof. Drainage Type G substitutes a lightweight, porous inorganic granular media embedded with slotted plastic triangular drainage conduit for the drainage plates. Granular drainage media is heavier and is more labor-intensive to install than drainage plates, but provides a superior environment for plant root growth. Drainage Type M utilizes three-layer geotextile mat that combines soil separation, drainage, water retention, and protection functions into one product. This system is the fastest to install and creates the thinnest and lightest green roof assembly. Since its drainage capacity is limited, it is primarily used for roofs with slopes not suitable for Drainage Type P or Type G, or for residential-scale green roofs



Drainage Type P Drainage Plate



Drainage Type G Drainage Media



Drainage Type M Drainage Mat

NOMINAL THICKNESS: The "nominal thickness" of a green roof is the approximate total height of the soil and drainage components that constitute the green roof system, excluding the roof structure, insulation, waterproofing, and plants. It is common practice to use the term "extensive" to describe green roofs that are very thin and will only support hardy, drought-resistant vegetation such as sedum, herbs, and perennials; "intensive" to describe green roofs that are thick enough to support a wider range of vegetation including grasses, shrubs, and small trees; and "semi-intensive" for roofs that are somewhere in between. These distinctions can

be more precisely quantified by the four thickness ranges shown below:



Thickness Type 1 2" to 4" sedum, herbs



Thickness Type 2 5" to 7" sedum, herbs, perennials



Thickness Type 3 8" to 11" perennials, grasses, shrubs



Thickness Type 4 12" + grasses, shrubs, trees



DRAINAGE PLATE SYSTEMS

Drainage Plate Systems are green roof systems underdrained with waffled sem-rigid plastic sheets called *drainage plates.* Water is retained within pockets on the upper sides of the plates while excess water flows through small holes and spills over the edges to be carried off the roof. A separation fabric over the top of the plates retains growing media while allowing water to drain freely. An air gap between the separation fabric and the high water level of the pockets provides additional drainage during heavy rains and prevents root rot. Drainage Plate Systems have very high drainage capacity in all directions which makes them ideal for roofs with slopes less than 1:12 in wet climates or climates with intense rainfall.



SYSTEM CHARACTERISTICS

Typical Cross-Section				
System Designation	P1	P2	P3	P4
Typical Plants	sedum herbs	sedum herbs perennials	perennials grasses shrubs	grasses shrubs trees
Growing Media	3" extensive	5" extensive	9" semi-intensive	13" intensive
Separation Fabric	6 oz/yd ²	6 oz/yd ²	6 oz/yd ²	6 oz/yd ²
Drainage Plate	1"	1"	1-1/2"	1-1/2"
Protection Mat	16 oz/yd ²	16 oz/yd ²	16 oz/yd ²	16 oz/yd ²
Root Barrier	30 mil	30 mil	30 mil	30 mil
Nominal Thickness	4"	6"	10"	14"
Saturated Weight	22 lbs/ft2	34 lbs/ft2	58 lbs/ft2	82 lbs/ft2
Annual Water Retention	50%	60%	70%	80%
Slope	level to 1:12	level to 1:12	level to 1:12	level to 1:12



DRAINAGE PLATE SYSTEM COMPONENTS

Root Barrier is a 30 mil (0.75mm) thick LLDPE sheet that provides exceptional resistance to root penetration, puncture, and tearing, yet offers good flexibility for ease of installation. It is highly resistant to environmental stresses on green roofs including air pollution, summer heat, and winter cold, and does not contain any recycled resins or plasticizers that can lead to premature aging or plant toxicity. Standard sizes are 10, 15, and 20 ft wide by 50 ft or 100 ft long. All sizes are folded so that the roll lengths are less than six feet. Seams should be taped or welded.

Protection Mat is a thick, 16 oz/yd² (540 g/m²), non-woven geotextile made from 100% recycled polyester fiber. Its toughness and puncture-resistance makes it ideal as a base protection layer for green roof systems. With a water storage capacity of 0.08 gal/ft² (3 l/m²) and moderate capillarity, it can retain and distribute water that would otherwise run off the roof. Rolls measure 6' x 67' (1.8m x 20.4m) and are electrically scanned for metal debris. A 6" (15 cm) overlap is recommended). *CT Water Retention Mat* can be substituted for enhanced stormwater runoff mitigation.

Drainage Plates are semi-rigid waffled plastic sheets that retain water within pockets on the upper side and drain water below. An air gap between separation fabric resting on top and the high water level of the pockets provides additional drainage capacity during heavy rains and prevents root rot. Small holes facilitate drainage but also allow air pressure equalization to minimize the potential for wind uplift. Sheets measure 39" x 79" (1m x 2m) and cover approximately 18 ft² (1.7 m²) of roof with a 3" (7.5 cm) overlap plus a minimal allowance for waste. Standard thickness are 1" (25mm), 1-1/2" (40mm), and 2-1/2" (60mm).

SeparationFabric-HD is a 6 oz/yd² (200 g/m²) porous, non-woven geotextile made from a blend of polypropylene and polyester fibers. Unlike common filter fabrics, it achieves mechanical strength without heat treatment and retains an open, three-dimensional surface structure that is highly resistant to clogging. The internal pore size distribution is carefully controlled to retain green roof planting media without restricting root penetration or water drainage. Rolls measure 6' x 100' (1.8m x 30.5m) and are electrically scanned for metal debris.

Drain Boxes are sturdy plastic roof drain covers made of black recycled ABS. Narrow slots on the sides and small holes on the top permit water to flow freely but retain growing and drainage medias. A wide base flange prevents flotation during repeated wet/ dry and freeze/thaw cycling, and a 12" hole in the base provides unobstructed drain access. The standard sidewall height is 4", but heights up to 32" in 4" increments are possible with sidewall extensions.



Aluminum Edge securely retains green roof planting media at roof edges and separates planting media from gravel, decks, or pavers. Slots in the vertical face provide unrestricted water drainage in the critical first inch off the roof while retaining virtually all green roof planting media without use of separation fabrics that inhibit water flow. Large holes in the base permit penetration-free fastening to underlying waterproofing, root barriers, or geotextiles. Wide bases resist rollover, and optional diagonal braces are available to minimize bending under heavy soil loading. Prefabricated internal and external fittings provide strong, attractive corners. A unique connector also slides into the folds of both the lineals and corners, locking into the vertical slots to provide tight joints that allow thermal movement. Standard heights are 3", 4", 6", and 8".

Growing Media is a blend of inorganic and organic components with a saturated, compacted density of 6 to 7 lb/ft² per inch of thickness (12-15 kg/m² per cm of thickness). The inorganic components are typically heat-expanded shale, heat-expanded clay, or natural pumice selected for high water retention, neutral pH, and low salt content. To minimize long-term settling and separation, inorganic particle sizes are uniformly and accurately graded from the several thousandths of an inch (fine sand) to 1/2" (12mm). A small amount of compost is blended with this inorganic base, typically 6% to 12% by weight depending on the plant palette. Coverage is typically 275 ft² one-inch thick per cubic yard (15m² one centimeter thick per cubic meter).

Drip Irrigation Tubing is typically installed just under the surface of the growing media, often tied to a soil-reinforcing mesh. Anti-siphon, pressure-compensating, self-flushing emitters are embedded in the tubing at one foot intervals and the tubing is installed in parallel rows spaced one foot apart. This provides a uniform application rate of 250 gallons per 1000 square feet per hour, allowing the planting media to capture all of the applied water and distribute it uniformly across the roof.

Reinforcing Mesh is a structural plastic mesh typically applied just under the surface of the growing media. It is used to strengthen media exposed to foot traffic, prevent wind uplift, and provide anchorage for irrigation tubing. Large openings do not block plant growth and are sufficiently large for sedum plugs. Rolls measure 6' x 150' (1.8m x 46m).

Extensive Roof Fertilizer is an ultra-slow-release micro-fertilizer specifically formulated to meet the nutritional requirement of sedum on extensive green roofs. It should be applied twice yearly beginning the second year, typically in April and July, at the rate of 2500 square feet per 10 lb pail.



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DRAINAGE PLATE SYSTEM INSTALLATION

Lay root barrier and protection mat: If the primary roof waterproofing is not root resistant, first apply Root Barrier, either welding or overlapping three feet with sealing tape in the overlap. Then unroll Protection Mat, overlapping adjacent sheets at least six inches. Cut openings in the root barrier and protection mat for each roof drain.



Conservation Technology



Install Aluminum Edge: Position Aluminum Edge at least 18" from roof edges. If there is a gravel perimeter, the gravel and planting media will exert even pressure so the retaining edge does not need to be attached. If there is no gravel perimeter, the retaining edge should be taped or welded to the waterproofing membrane before the protection mat is installed.

Lay Drainage Plates: Position Drainage Plates in a staggered pattern, overlapping sides and ends by two cups. Multiple layers of plastic plates can be easily cut with a circular saw, or half-sheets can be purchased to speed installation. Carefully place or cut the drainage plates within 1/4" of the interior of CT Retaining Edge.





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Lay Separation Fabric: Unroll Separation Fabric HD over the drainage plates, overlapping adjacent sheets at least six inches. Cut the fabric to length so that it wraps up the interior of the retaining edge. The underlying drainage plates must be sufficiently close to the retaining edge so that the fabric cannot drop down to block the drainage slots.



Spread Planting Media: Uniformly apply growing media at the rate of one cubic yard per 275 square feet per inch thickness, taking care not to displace retaining edges or to create concentrated roof loads. Place material at least 15% higher than the desired grade and compact using a four foot wide landscape roller weighing 200 to 300 lbs when filled. Add more media if necessary to fill low spots.

Plant: Insert plugs two to three per square foot in a random pattern, broadcast cuttings at the rate of 60 to 100 pounds per 1000 square feet, or place sedum mats. Water thoroughly after installation and as needed to prevent excessive drying until the plants are fully established. Broadcast Extensive Roof Fertilizer twice yearly.









DRAINAGE MEDIA SYSTEMS

Drainage Media Systems are green roof systems underdrained with a layer of uniformly graded, lightweight, inorganic media. A high-performance capillary mat below the media captures and distributes excess water that drains through the media, while a network of slotted plastic drainage conduit above the mat provides supplemental drainage during heavy rainfall. During extended periods of dry weather, optional drip-irrigation lines placed directly over the capillary mat can provide super-efficient, uniform water delivery and encourage deep root growth. Although granular media is heavier than other green roof drainage materials, it provides an optimal environment for plant root growth for roofs with slopes less than 1:12.



SYSTEM CHARACTERISTICS

Typical Cross-Section				
System Designation	G1	G2	G3	G4
Typical Plants	sedum herbs	sedum herbs perennials	perennials grasses shrubs	grasses shrubs trees
Growing Media	2" extensive	4" extensive	6" semi-intensive	10" intensive
Separation Fabric	4 oz/yd ²	4 oz/yd ²	4 oz/yd ²	4 oz/yd ²
Drainage Media	2"	2"	4"	4"
Capillary Mat	28 oz/yd ²	28 oz/yd ²	28 oz/yd ²	28 oz/yd ²
Root Barrier	30 mil	30 mil	30 mil	30 mil
Nominal Thickness	4"	6"	10"	14"
Saturated Weight	25 lbs/ft2	37 lbs/ft2	60 lbs/ft2	84 lbs/ft2
Annual Water Retention	50%	60%	70%	80%
Slope	level to 1:12	level to 1:12	level to 1:12	level to 1:12

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DRAINAGE MEDIA SYSTEM COMPONENTS

Root Barrier is a 30 mil (0.75mm) thick LLDPE sheet that provides exceptional resistance to root penetration, puncture, and tearing, yet offers good flexibility for ease of installation. It is highly resistant to environmental stresses on green roofs including air pollution, summer heat, and winter cold, and does not contain any recycled resins or plasticizers that can lead to premature aging or plant toxicity. Standard sizes are 10, 15, and 20 ft wide by 50 ft or 100 ft long. All sizes are folded so that the roll lengths are less than six feet. Seams should be taped or welded.

Capillary Mat is a thick, 28 oz/yd² (950 g/m²), non-woven geotextile made from 100% polyester fiber. It is non-biodegradable, is highly puncture resistant, has a water storage capacity of 0.1 gal/ft² (4.2 l/m²), and spreads water in all directions including more than six inches vertically. These properties make it ideal for protection, water storage, and water distribution in green roof systems. Rolls measure 6' x 50' (1.8m x 15.3m) and are electrically scanned for metal debris. A 6" (15 cm) overlap is recommended).

Triangular Drainage Conduits are black recycled ABS plastic drainage elements with continuous slotting on each side. They are embedded in Granular Drainage Media to carry excess water to roof drains or scuppers during periods of heavy rainfall. Each element is 40" (1 m) long and 2" (5 cm) tall. The unique triangular cross-section provides optimal surface area and prevents the channel from floating upward during repeated wet/dry and freeze/ thaw cycling. Interlocking ends allow rotation, and tees are available to create branched drainage systems.

Drain Boxes are sturdy plastic roof drain covers made of black recycled ABS. Narrow slots on the sides and small holes on the top permit water to flow freely but retain growing and drainage medias. A wide base flange prevents flotation during repeated wet/ dry and freeze/thaw cycling, and a 12" hole in the base provides unobstructed drain access. Triangular knockouts in each sidewall panel accept Triangular Drainage Conduit.

Aluminum Edge securely retains green roof planting media at roof edges and separates planting media from gravel, decks, or pavers. Slots in the vertical face provide unrestricted water drainage in the critical first inch off the roof while retaining virtually all green roof planting media. Large holes in the base permit penetration-free fastening to underlying waterproofing, root barriers, or geotextiles. Wide bases resist rollover, and optional diagonal braces are available to minimize bending under heavy soil loading. Prefabricated internal and external fittings provide strong, attractive corners. A unique connector also slides into the folds of both the lineals and corners, locking into the vertical slots to provide tight joints that allow thermal movement.



Drip Irrigation Tubing is typically installed at the base of a granular drainage system, either directly on the Capillary Mat or over the Granular Drainage Media. Anti-siphon, pressure-compensating, self-flushing emitters embedded in the tubing provide a controlled application rate of only 100 gallons per 1000 squre feet per hour. At this rate, the Capillary Mat captures all of the applied water and distribute it uniformly across the roof. Bottom-irrigation encourages deeper root growth than surface or sub-surface irrigation and reduces evaporative losses.

Granular Drainage Media is a water-retaining, free-draining, lightweight inorganic media that serves both as a drainage layer and as a root-development zone. It is made from heat-expanded shale, heat-expanded clay, or natural pumice selected for neutral pH and low salt content. Particle sizes are uniformly and accurately graded from 1/8" (3mm) to 1/2" (12mm) to minimize settling and separation. Typical saturated compacted densities are 4 to 5 lb/ ft² per inch of thickness (8 to 10 kg/m² per cm of thickness), and coverage is typically 300 ft² one inch thick per cubic yard (16m² one centimeter thick per cubic meter).

Separation Fabric SD is a 4 oz/yd² (135 g/m²) porous, non-woven geotextile made from a blend of polypropylene and polyester fibers. Unlike common filter fabrics, it achieves mechanical strength without heat treatment and retains an open, three-dimensional surface structure that is highly resistant to clogging. The internal pore size distribution is carefully controlled to retain green roof planting media without restricting root penetration or water drainage. Rolls measure 6' x 100' (1.8m x 30.5m and are electrically scanned for metal debris.

Growing Media is a blend of inorganic and organic components with a saturated, compacted density of 6 to 7 lb/ft² per inch of thickness (12-15 kg/m² per cm of thickness). The inorganic components are typically heat-expanded shale, heat-expanded clay, or natural pumice selected for high water retention, neutral pH, and low salt content. To minimize long-term settling and separation, inorganic particle sizes are uniformly and accurately graded from the several thousandths of an inch (fine sand) to 1/2" (12mm). A small amount of compost is blended with this inorganic base, typically 6% to 12% by weight depending on the plant palette. Coverage is typically 275 ft² one-inch thick per cubic yard (15m² one centimeter thick per cubic meter).

Extensive Roof Fertilizer is an ultra-slow-release micro-fertilizer specifically formulated to meet the nutritional requirement of sedum on extensive green roofs. It should be applied twice yearly beginning the second year, typically in April and July, at the rate of 2500 square feet per 10 lb pail.







Lay root barrier and capillary mat:

If the primary roof waterproofing is not root resistant, first apply Root Barrier, either welding or overlapping three feet with sealing tape in the overlap. Then unroll Capillary Mat, overlapping adjacent sheets at least six inches. Cut openings in the root barrier and protection mat for each roof drain.

Install Aluminum Edge: Position Aluminum Edge at least 18" from roof edges. If there is a gravel perimeter, the gravel and planting media will exert even pressure so the retaining edge does not need to be attached. If there is no gravel perimeter, the retaining edge should be taped or welded to the waterproofing membrane before the protection mat is installed.

Install Drainage System: Position Drain Boxes over roof drains, adding sidewall elements as needed to match the system thickness. Construct drainage "trees" using triangular drainage channels and tees so that the "branches" positioned so that every point on the roof is within two channel lengths of the closest point of the drainage tree.

Spread Granular Media: Uniformly apply Granular Drainage Media to the top of the drainage channels, or approximately one cubic yard per 150 square feet. For intensive greenroofs, apply one cubic year per 75 square feet.







Lay Separation Fabric: Unroll Separation Fabric over the drainage media, overlapping adjacent sheets at least six inches. Cut the fabric to length so that it wraps up the interior of the retaining edge.

Spread Gravel Perimeter: Spread well-washed gravel screened to 3/8" minimum particle size. Be careful not to displace retaining edges or to create concentrated roof loads.

Spread Planting Media: Uniformly apply growing media at the rate of one cubic yard per 300 square feet per inch thickness, taking care not to displace retaining edges or to create concentrated roof loads. Place material at least 15% higher than the desired grade and compact using a four foot wide landscape roller weighing 200 to 300 lbs when filled. Add more media if necessary to fill low spots.

Plant: Insert plugs two to three per square foot in a random pattern, broadcast cuttings at the rate of 60 to 100 pounds per 1000 square feet, or place sedum mats. Water thoroughly after installation and as needed to prevent excessive drying until the plants are fully established. Broadcast Extensive Roof Fertilizer twice yearly.







DRAINAGE MAT SYSTEMS

Drainage Mat Systems are green roof systems underlaid with a geotextile composite called *Capillary Drainage Mat* that provides separation, drainage, water storage, and protection functions, eliminating the need for multiple components. The top layer is a separation fabric that retains green roof planting media while allowing unrestricted root penetration and water drainage; the middle layer is a coarse-fiber mat that provides controlled drainage; and the bottom layer is a punctureresistant capillary mat with exceptional water storage and distribution properties. Drainage Mat Systems are ideal for sloped green roofs that require high water retention with limited drainage. They also provide a simple solution for residential and small commercial green roofs with slopes as low as 1/4:12.

A structural slope-stabilization mesh is recommended when slopes are greater than 1:12; When slopes are greater than 2:12, cleats should be attached to the mesh and the system may require anchoring. Drip irrigation tubing attached to the mesh wets the capillary mat which captures and distributes the water.





stabilization mesh with cleat

Typical Cross-Section		
System Designation	G1	G2
Typical Plants	sedum herbs	sedum herbs perennials
Growing Media	3" extensive	5" extensive
Slope Stabilization Mesh	2" x 2"	2" x 2"
Capillary Drainage Mat	50 oz/yd ²	50 oz/yd ²
Root Barrier	30 mil	30 mil
Nominal Thickness	3"	5"
Saturated Weight	22 lbs/ft2	34 lbs/ft2
Annual Water Retention	50%	60%
Slope	> 1/4:12	> 1/4:12

SYSTEM CHARACTERISTICS



DRAINAGE MAT SYSTEM COMPONENTS

Root Barrier is a 30 mil (0.75mm) thick LLDPE sheet that provides exceptional resistance to root penetration, puncture, and tearing, yet offers good flexibility for ease of installation. It is highly resistant to environmental stresses on green roofs including air pollution, summer heat, and winter cold, and does not contain any recycled resins or plasticizers that can lead to premature aging or plant toxicity. Standard sizes are 10, 15, and 20 ft wide by 50 ft or 100 ft long. All sizes are folded so that the roll lengths are less than six feet. Seams should be taped or welded. Root barriers are not recommended when slopes are greater than 1:12 - use root-resistant waterproofing instead.

Capillary Drainage Mat is a 50 oz/yd² (1700 g/m²) thermally-bonded laminate of three geotextiles. The top layer is Separation Fabric-SD with inter-fiber spaces carefully controlled to retain green roof planting media while allowing unrestricted root penetration and water drainage. The middle layer is a coarse-fiber mat with large inter-fiber spaces that provide controlled lateral water flow. The bottom layer is Capillary Mat with exceptional water storage capacity that can wick water vertically in excess of 6 inches. This composite also provides extraordinary mechanical strength and puncture resistance. Its dense structure assures that it will will retain its hydraulic properties under long-term loading. Rolls measure 6' x 33.3' (1.8m x 10.2m) and are electrically scanned for metal debris. A 6" (15 cm) overlap is recommended.

Slope-Stabilization Mesh is a structural, coated-polyester mesh applied directly over Capillary Drainage Mat to distribute stresses on the mat, reinforce planting media, and provide anchorage for drip-irrigation tubing. When slopes are greater than 2:12, structural cleats are attached to the mesh to better transfer sliding forces from the media to the mesh. Since the mesh has large openings, water movement from the media to the mat and from the mat to the media is unaffected. The mesh is always unrolled in the direction of slope. Rolls measure 6' x 150' (1.8m x 46m). A 6" (15 cm) overlap is recommended.

Anti-Slip Cleats are plastic soil-retaining elements made of black recycled ABS. They are always used in conjunction with Slope-Stabilization Mesh and prevent soil from sliding down sloped green roofs by using the mesh to transfer soil loads to the top of the roof. If the roof is gabled or barrel-shaped, one side of the roof can be used to balance the other; otherwise the mesh must be mechanically fastened at the top of the roof. Rows of cleats are spaced 10" to 50", depending on the roof slope, and each row is offset from the rows above and below in order to equalize stresses on the mesh.



Drain Boxes are sturdy plastic roof drain covers made of black recycled ABS. Narrow slots on the sides and small holes on the top permit water to flow freely but retain growing and drainage medias. A wide base flange prevents flotation during repeated wet/ dry and freeze/thaw cycling, and a 12" hole in the base provides unobstructed drain access. The standard sidewall height is 4", but heights up to 32" in 4" increments are possible with sidewall extensions.

Drip Irrigation Tubing is typically installed just under the surface of the growing media, often tied to a soil-reinforcing mesh. Anti-siphon, pressure-compensating, self-flushing emitters are embedded in the tubing at one foot intervals and the tubing is installed in parallel rows spaced one foot apart. This provides a uniform application rate of 250 gallons per 1000 square feet per hour, allowing the planting media to capture all of the applied water and distribute it uniformly across the roof.

Aluminum Edge securely retains green roof planting media at roof edges and separates planting media from gravel, decks, or pavers. Slots in the vertical face provide unrestricted water drainage in the critical first inch off the roof while retaining virtually all green roof planting media without use of separation fabrics that inhibit water flow. Large holes in the base permit penetration-free fastening to underlying waterproofing, root barriers, or geotextiles. Wide bases resist rollover, and optional diagonal braces are available to minimize bending under heavy soil loading. Prefabricated internal and external fittings provide strong, attractive corners. A unique connector also slides into the folds of both the lineals and corners, locking into the vertical slots to provide tight joints that allow thermal movement.

Growing Media is a blend of inorganic and organic components with a saturated, compacted density of 6 to 7 lb/ft² per inch of thickness (12-15 kg/m² per cm of thickness). The inorganic components are typically heat-expanded shale, heat-expanded clay, or natural pumice selected for high water retention, neutral pH, and low salt content. To minimize long-term settling and separation, inorganic particle sizes are uniformly and accurately graded from the several thousandths of an inch (fine sand) to 1/2" (12mm). A small amount of compost is blended with this inorganic base, typically 6% to 12% by weight depending on the plant palette. Coverage is typically 275 ft² one-inch thick per cubic vard (15m² one centimeter thick per cubic meter).

Extensive Roof Fertilizer is an ultra-slow-release micro-fertilizer specifically formulated to meet the nutritional requirement of sedum on extensive green roofs. It should be applied twice yearly beginning the second year, typically in April and July, at the rate of 2500 square feet per 10 lb pail.







Install Aluminum Edge: Position Aluminum Edge near the roof edge and tape or weld it to the waterproofing membrane through the large holes in the base flange. Use fabricated corners for strength and join all parts with locking connectors.

Lay Capillary Drainage Mat: If the primary roof waterproofing is not root resistant, and if the roof slope is less than 1:12, apply Root Barrier, either welding or overlapping three feet with sealing tape in the overlap. Then unroll Capillary Drainage Mat, overlapping adjacent sheets at least six inches. The mat should fully cover the base flange of the aluminum edge but should not turn up the vertical legs. (Note: If the slope is greater than 1:12, the primary waterproofing must be root resistant.

Unroll Slope Stabilization Mesh: Slope stabilization mesh is required when slopes are greater than 1:12. Unroll the mesh in the slope direction, overlapping at least six inches. For gable or barrel-vault roofs with equal slopes in opposite directions, it is essential that a single length of mesh runs from one eave to the other so that soil loads on one half of the roof balance the other half. For shed roofs or half vaults, the mesh must be structurally anchored at the high end of the roof with a system approved by a structural engineer.

Attach Slope Stabilization Cleats:

The cleats clip onto the mesh and are required when slopes are greater than 2:12. Conservation Technology will supply a drawing showing the row spacing and location of all cleats. Note that cleats in adjacent rows must be offset one-quarter cleat to distribute the structural load on the mesh.



Conservation Technology



Fasten Drip Irrigation Tubing: Drip irrigation is recommended for all green roofs with slopes greater than 1:12. Conservation Technology will supply a drawing showing the row spacing and location of all drip lines which can be attached to the slope-stabilization mesh with plastic tie strips.

Spread Planting Media: Uniformly apply growing media at the rate of one cubic yard per 300 square feet per inch thickness, taking care not to displace retaining edges or to create concentrated roof loads. Place material at least 15% higher than the desired grade to allow for compaction.

Spread Gravel Perimeter: Spread well-washed gravel screened to 3/8" minimum particle size. Be careful not to displace retaining edges or to create concentrated roof loads.

Plant: Insert plugs two to three per square foot in a random pattern, broadcast cuttings at the rate of 60-100 pounds per square foot, or unroll sedum mats. Water thoroughly after installation and as needed to prevent excessive drying until the plants are fully established. Broadcast Extensive Roof Fertilizer twice yearly.

Note: The sequence above is for roofs without parapet walls and with slopes greater than .For roofs with parapet walls, install the aluminum approximately 18" from the parapet and fill the space between with gravel.





MODULAR SYSTEM

CT Modular Green Roof System combines the aesthetics and performance of continuous green roof systems with the simplicity of pre-vegetated trays. Slotted sidewalls encourage plant root growth between modules, creating a natural-looking meadow with invisible boundaries. Slotted flat bottoms permit water to move freely both in and out of the modules with assistance from an underlying waterretaining capillary mat that maintains uniform moisture levels across the roof. Stormwater is carried away in integral drainage channels that double as conduits for drip irrigation. Adjacent modules interlock with easily removable connectors. Fully saturated system weights as low as 12 lbs/ft² make it possible to retrofit existing roofs that cannot support the weight of continous systems.

SYSTEM ANATOMY

The system has four principal components:

- · a thick, water-retaining capillary protection mat
- a support tray made from a tough, flexible, recycled polypropylene copolymer with slots in the sidewall and bottom surfaces small enough to retain growing media, yet large enough to allow plant roots and water to pass freely
- a lightweight growing media with enhanced water retention, capillarity, and drainage characteristics
- an optional fully-vegetated organic mat planted with drought-resistant sedum

The trays are filled with the lightweight growing media, which is then compacted and stacked on pallets for shipping to the jobsite. On the rooftop, the modules are laid on capillary protection mat, a heavy-duty water-retaining geotextile that can distribute water in all directions. After installation, the trays are directly planted with cuttings or plugs or overlaid with sedum mats.

pre-planted module on capillary mat



exploded view of system compone

WATER MANAGEMENT

Rainwater drains freely through the bottom slots and into the water-retaining capillary mat which spreads the water uniformly across the roof (A). When the mat becomes fully saturated, excess water is carried away through the high-volume semi-circular drainage conduits formed by adjacent tray edges (B). During periods of dry weather, drip irrigation lines passing invisibly through the drainage conduits are used to wet the water storage mat (C). The irrigation water spreads across the mat and rises into the trays by capillarity and by vapor diffusion (D).



cross-section showing water flow



CONNECTING MODULES

Adjacent modules are joined with plastic connectors that snap into holes at the corners of the trays: four-prong connectors are used in the center of the roof, and two-prong connectors are used at the edges. The holes that receive the connectors are open at the bottom, so any growth media or plant matter that enters the top falls straight through without blocking the holes. Since the connectors tolerate significant variations in fit, it is not necessary to carefully fit or clean tray edges, and roof surfaces do not need to be perfectly clean or flat. The connectors lock securely in place without tools and can be easily removed with an ordinary flat-blade screwdriver. Since the trays do not overlap, any module can be removed quickly for replacement or for access to the underlying waterproofing.





MODULAR SYSTEM COMPONENTS

Root Barrier is a 30 mil (0.75mm) thick LLDPE sheet that provides exceptional resistance to root penetration, puncture, and tearing, yet offers good flexibility for ease of installation. It is highly resistant to environmental stresses on green roofs including air pollution, summer heat, and winter cold, and does not contain any recycled resins or plasticizers that can lead to premature aging or plant toxicity. Standard sizes are 10, 15, and 20 ft wide by 50 ft or 100 ft long. All sizes are folded so that the roll lengths are less than six feet. Seams should be taped or welded.

Capillary Mat is a thick, 28 oz/yd² (950 g/m²), non-woven geotextile made from 100% polyester fiber. It is non-biodegradable, is highly puncture resistant, has a water storage capacity of 0.1 gal/ft² (4.2 l/m²), and spreads water in all directions including more than six inches vertically. These properties make it ideal for protection, water storage, and water distribution in green roof systems. Rolls measure 6' x 50' (1.8m x 15.3m) and are electrically scanned for metal debris. A 6" (15 cm) overlap is recommended).

Modular Trays are made of black recycled polyproplene plastic and have continuous slotting on the bottom and all sides. Each tray is 19-3/4" (50 cm) long, 15-3/4" (40 cm) wide and 2" (5 cm) tall. The unique edge design creates drainage channels to drain excess water and to provide a conduit for drip irrigation lines. Adjacent modules interlock with easily removable connectors.

Drain Boxes are sturdy plastic roof drain covers made of black recycled ABS. Narrow slots on the sides and small holes on the top permit water to flow freely but retain growing and drainage medias. A wide base flange prevents flotation during repeated wet/ dry and freeze/thaw cycling, and a 12" hole in the base provides unobstructed drain access. Triangular knockouts in each sidewall panel accept Triangular Drainage Conduit.

Aluminum Edge securely retains green roof planting media at roof edges and separates planting media from gravel, decks, or pavers. Slots in the vertical face provide unrestricted water drainage in the critical first inch off the roof while retaining virtually all green roof planting media. Large holes in the base permit penetration-free fastening to underlying waterproofing, root barriers, or geotextiles. Wide bases resist rollover, and optional diagonal braces are available to minimize bending under heavy soil loading. Prefabricated internal and external fittings provide strong, attractive corners. A unique connector also slides into the folds of both the lineals and corners, locking into the vertical slots to provide tight joints that allow thermal movement.





Drip Irrigation Tubing is typically installed at the base of a granular drainage system, either directly on the Capillary Mat or over the Granular Drainage Media. Anti-siphon, pressure-compensating, self-flushing emitters embedded in the tubing provide a controlled application rate of only 100 gallons per 1000 squre feet per hour. At this rate, the Capillary Mat captures all of the applied water and distribute it uniformly across the roof. Bottom-irrigation encourages deeper root growth than surface or sub-surface irrigation and reduces evaporative losses.

Single-Course Growing Media is a blend of inorganic and organic components with a saturated, compacted density of 5 to 6 lb/ ft² per inch of thickness (10-12 kg/m² per cm of thickness). The inorganic components are typically heat-expanded clay or natural pumice selected for high water retention, neutral pH, and low salt content. To minimize long-term settling and separation, inorganic particle sizes are uniformly and accurately graded from the several hundredths of an inch (coarse sand) to 1/2" (12mm). A small amount of compost is blended with this inorganic base, typically 6% to 12% by weight depending on the plant palette. Coverage is typically 275 ft² one-inch thick per cubic yard (15m² one centimeter thick per cubic meter).

Extensive Roof Fertilizer is an ultra-slow-release micro-fertilizer specifically formulated to meet the nutritional requirement of sedum on extensive green roofs. It should be applied twice yearly beginning the second year, typically in April and July, at the rate of 2500 square feet per 10 lb pail.

FlexDrain is a flexible, tough, dimpled polypropylene sheet that can be installed beneath the Capillary Mat to create a drainage and ventilation cavity. This allows stormwater from adjacent roof areas to flow under the modular system to reach drains. When the green roof is used over a protected membrane (inverted) roof, it preserves the thermal value of the polystyrene insulation. Adjacent sheets precisely overlap and interlock for gap-free coverage, and six-foot wide rolls minimize the number of seams.



MODULAR SYSTEM INSTALLATION

Install Aluminum Edge: Position Aluminum Edge near the roof edge and tape or weld it to the waterproofing membrane through the large holes in the base flange. Use fabricated corners for strength and join all parts with locking connectors. If the roof is surrounded by parapet walls, aluminum edge is not required

Lay root barrier and capillary mat:

If the primary roof waterproofing is not root resistant, first apply Root Barrier, either welding or overlapping three feet with sealing tape in the overlap. Then unroll Capillary Mat, overlapping adjacent sheets at least six inches. The mat should fully cover the base flange of the aluminum edge but should not turn up the vertical legs.

Place Drip Irrigation Tubing: Drip irrigation lines should be installed between every other tray. Cut the drip lines longer than required and create a header on one side using tee and elbow fittings to connect to plain drip tubing (without emitters).

Begin Tray Installation: Starting at the end of the roof with the drip header, place trays tightly butted together. After each row is placed, insert tray connectors between the last two rows. If a connector does not seat fully, clean out the holes with a blunt, small diameter object such as a wood dowel. Make certain the drip lines fit between the trays without binding.







Finish Tray Installation: After placing and connecting all of the trays, trim the drip lines as required and create a header on the second side using tee and elbow fittings to connect to plain drip tubing. Connect one end of the header to the water supply.

Spread Gravel Perimeter: Spread well-washed gravel screened to 3/8" minimum particle size. Be careful not to create concentrated roof loads.

Plant: Insert plugs two to three per square foot in a random pattern, broadcast cuttings at the rate of 60-100 pounds per square foot, or unroll sedum mats. Water thoroughly after installation and as needed to prevent excessive drying until the plants are fully established. Broadcast Intensive Roof Fertilizer twice yearly.





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DRAINPLATE-25HS

DrainPlate-25HS is a 1" (25mm) tall, three-dimensional plastic drainage structure for green roofs made of high-density polyethylene. Unlike flexible drainage sheets made of thin plastic, this is a thick, semi-rigid, high-strength product designed to last a lifetime and to withstand heavy pedestrian traffic. Cavities on the upper side provide a small amount of supplemental water storage, while passageways on the underside provide high-rate storm drainage. Small holes at the middle of the sheet height assures there is always an air gap between the filter mat and water, preventing waterlogged soil. Precision molding makes it possible to cleanly overlap adjacent sheets.

TECHNICAL DATA

Dimensions: 39" x 79" x 1" or 39" x 39" x 1" (1m x 1m x 25mm or 1m x 2m x 25mm)

Gross Surface Area: 21.5 ft²/plate (2 m²/plate)

Net Coverage: 19 ft²/plate (1.75 m²/plate)

Weight: 0.33 lb/ft², 7.0 lb/plate (1.6 kg/m², 3.2 kg/plate)

Packaging: 350 plates (7500 ft² or 700 m²) per pallet

Material: black 100% post-consumer recycled HDPE

Water Retention: 0.12 gal/ft² (5 l/m²)

Aggregate Fill Volume: 0.025 ft³/ft² (7.5 l/m²)

Compressive Strength (unfilled): 5240 psf (251 kPa)

INSTALLATION PROCEDURE

• Lay plates over Protection Mat overlapped 6". For inverted roofs, lay plates over Protection Mesh.

- Overlap adjacent plates by two corrugations.
- Stagger joints in adjacent rows by one-half sheet so that there are no more than three layers at any point.
- Cut single plates with a sharp utility knife, using a board to protect underlying materials from damage. Cut multiple plates off the roof with a circular saw. Half sheets can also be purchased to speed installation of staggered patterns.
- Fill plates immediately with water to prevent uplift in windy conditions or to prevent expansion on sunny days.
- Before applying standard green roof medias, lay Separation Fabric-HD over plates, overlapping 6".
- Spread engineered green roof planting media.

Flow Rate:

Hydraulic Gradient	Flow Rate (gal/min/ft)	Flow Rate (liters/sec/m)
l = 0.01	4.8	1.0
i = 0.02	6.6	1.4
i = 0.05	11.0	2.2
i = 0.10	15.0	3.1
i = 1.00	49.0	10.0







DRAINPLATE-40HP

DrainPlate-40HP is a 1-1/2" tall three-dimensional plastic structure for green roofs made of high-density polyethylene. Unlike flexible drainage sheets made of thin plastic, this is a thick, semi-rigid product designed to last a lifetime and to withstand heavy pedestrian traffic. Cavities on the upper side provide a small amount of supplemental water storage, while passageways on the underside provide high-rate storm drainage. Small holes at the middle of the sheet height assures there is always an air gap between the filter mat and water, preventing waterlogged soil. Precision molding makes it possible to cleanly overlap adjacent sheets.

TECHNICAL DATA

Dimensions: 39" x 79" x 1.5" (1 m x 2 m x 40mm) Gross Surface Area: 21.5 ft²/plate (2 m²/plate) Net Coverage: 19 ft²/plate (1.75 m²/plate) Weight: 0.5 lb/ft², 11 lb/plate (2.3 kg/m², 4.6 kg/plate) Packaging: 300 plates (6450 ft² or 600 m²) per pallet Material: black 100% post-consumer recycled HDPE Water Retention: 0.22 gal/ft² (9 l/m²) Aggregate Fill Volume: 0.06 ft³/ft² (17 l/m²) Compressive Strength (unfilled): 2080 psf (100 kPa)

INSTALLATION PROCEDURE

• Lay plates over Protection Mat overlapped 6". For inverted roofs, lay plates over Protection Mesh.

- · Overlap adjacent plates by two corrugations.
- Stagger joints in adjacent rows by one-half sheet so that there are no more than three layers at any point.
- Cut single plates with a sharp utility knife, using a board to protect underlying materials from damage. Cut multiple plates off the roof with a circular saw. Half sheets can also be purchased to speed installation of staggered patterns.
- Fill plates immediately with water to prevent uplift in windy conditions or to prevent expansion on sunny days.
- Before applying green roof media, lay Separation Fabric HD over plates, overlapping 6".
- · Spread engineered green roof planting media.

Flow Rate:

Conservation Technology 410-366-1146 www.conservationtechnology.com

Flow Rate (gal/min/ft)	Flow Rate (liters/sec/m)
7.7	1.6
11.2	2.3
18.1	3.8
26.0	5.4
80.4	16.6
	Flow Rate (gal/min/ft) 7.7 11.2 18.1 26.0 80.4







DRAINPLATE-60HV

DrainPlate-60HV is a 2-1/2" tall three-dimensional plastic water storage and drainage structure for green roofs made of recycled high-density polyethylene. Typically the entire top surface is filled with a lightweight inorganic aggregate to support the separation fabric and planting media above. Approximately 0.9" of water is stored permanently in void spaces within the pockets, and an additional 0.9" of watr is stored temporarily in void spaces above the pockets. Passageways on the underside provide storm drainage as well a ventilation for inverted roofs. When filled with lightweight aggregate, the assembly has extraordinarily high compressive strength.

TECHNICAL DATA

Dimensions: 40" x 80" x 2-1/2" (1m x 2m x 60mm) Gross Surface Area: 22.5 ft²/plate (2.1 m²/plate) Net Coverage: 22,5 ft²/plate (2.1 m²/plate) Weight: 0.72 lb/ft², 16.1 lb/plate (3.5 kg/m², 7.3 kg/plate) Packaging: 180 plates (4050 ft² or 375 m²) per pallet Material: black 100% post-consumer recycled HDPE Aggregate Fill Required: 0.15 ft³/ft² (45 l/m²) Long-Term Water Retention: 0.57 gal/ft² (23 l/m²)* Temporary Water Retention: 0.55 gal/ft² (22 l/m²)* Compressive Strength: 14,500 psf (695 kN/m2)*

INSTALLATION PROCEDURE

• Lay plates over Protection Mat overlapped 6". For inverted roofs, lay plates over Protection Mesh.

• Cut single plates with a sharp utility knife, using a board to protect underlying materials from damage. Cut multiple plates off the roof with a circular saw.

• Butt panels tightly together, staggering end joints by one-half sheet.

• Fill plates immediately with 1/4" to 5/8"(6mm-16mm) lightweight aggregate to prevent uplift in windy conditions, to prevent expansion on sunny days, and to allow foot traffic over installed plates. Fill completely to the top of the ribs.

· Lay Separation Fabric HD over plates, overlapping 6".

• Spread engineered green roof planting media.

Flow Rate:

Hydraulic Gradient	Flow Rate (gal/min/ft)	Flow Rate (liters/sec/m)
l = 0.01	2.8	0.6
i = 0.02	4.1	0.8
i = 0.05	6.6	1.4
i = 0.10	9.5	1.9
i = 1.00	31.6	6.5





X-BOX

X-Box is a high-strength plastic structure that can be installed under green roofs to provide uninterrupted drainage, to delay stormwater release, to provide high-volume water storage, or to create lightweight topographic relief. Standard heights are 4", 6", 8", 10", and 12" (16" and 24" are available on special order), but modules can be stacked to create unlimited heights in two-inch increments. Modules can be joined horizontally with locking butterfly connectors and vertically with alignment pins to create complex three-dimensional shapes without the positioning, wind uplift, or flotation issues of geofoam.

All X-Box modules have 64 full-height support columns, making them significantly stronger than other low-profile modules. With a 50-year long-term load capacity of 4,000 lb/sf, they can support pre-cast walls, planters, and other rooftop hardscapes, freeing the designer from roof drainage and stormwater management constraints.



PHYSICAL CHARACTERISTICS



(also available 6", 8", and 10")





Property	US	Metric
Base	23.5" x 23.5"	60cm x 60cm
Height	4", 6", 8", 10", 12"	10cm, 15cm, 20cm, 25cm, 30cm
Unit Water Storage*	0.6 gal/in/ft ²	x 13.7 l/cm/m ²
Unit Weight*	0.25 lb/in/ft ²	0.045 kg/cm/m ²
Short-Term Load Capacity	13,500 lb/ft ²	650 kN/m ²
Long-Term (50 year) Load Capacity	4,000 lb/ft ²	200 kN/m ²

* Example: for 6" modules, water storage = 6" x 0.6 gal/in/ft² = 3.6 gal/ft² and weight = 6" x 0.25 lb/in/ft² = 1.5 lb/ft²



ROOFTOP CISTERN

The X-Box is ideal for creating a low-profile rainwater cistern under a green roof. First a durable ponding membrane, for example a sheet of EPDM rubber, is placed over the primary waterproofing and lapped up the parapet walls. Then modules are placed on the ponding membrane, completely covering the surface. Since X-Box modules are available in 2" increments of height and typical roofs slope 1/4" per foot towards the roof drains, the module height should be increased by 2" every eight feet (four modules) to maximize water storage capacity while leveling the green roof. Lastly, a standpipe over the drain is set to the desired water-retention height. In freezing climates the standpipe should be designed to be removed in the winter. A special abrasion-resistant pump that draws down to one-eight inch makes it possible to irrigate the roof above.





DRAIN BOX

Drain Boxes are sturdy plastic roof drain covers made of black recycled ABS which is highly resistant to biological decomposition and environmental deterioration. Narrow slots on the sides and small holes on the top permit water to flow freely but retain growing and drainage medias. A wide base flange prevents flotation during repeated wet/ dry and freeze/thaw cycling, and a 12" hole in the base provides unobstructed drain access. Triangular knockouts in each sidewall panel accept Triangular Drainage Conduit used for granular media drainage systems.

Each Drain Box includes a top cover, base plate, and a 16" sidewall plate that can be split into four 4" sidewall elements to make a 4" tall assembly for extensive green roofs. By splitting the sidewall plates differently or using them whole, assemblies can be built for semi-intensive or intensive green roofs in any 4" height increment up to 32".



DIMENSIONS





0 0

14-1/2"



TRIANGULAR DRAINAGE CONDUIT

Triangular Drainage Conduits are slotted plastic drainage structures designed to be embedded in granular drainage media. The sloped sidewalls are continuously slotted, providing optimal water flow while blocking entry of the drainage media. The triangular cross-section with wide bottom flanges prevents the conduit from floating upward during repeated wet/dry and freeze/thaw cycling. Interlocking ends allow up to 90° rotation to accommodate changes in direction. The conduits are made of black, recycled ABS which is highly resistant to biological decomposition and environmental deterioration.

Triangular Drainage Conduits are typically used to carry excess water from green roofs during periods of heavy rainfall, or to drain water at the base of down-flow biofiltration beds. They can also be employed in reverse as a water distribution system for flood irrigation.



DIMENSIONS



42"

ACCESSORIES

Triangular Drainage Conduits are typically used with Conduit Wyes to create complete drainage networks that connect to Drain Boxes. The conduits slide into the triangular knockouts on the sides of the access boxes, creating an unobstructed flow pathway to roof drains.



conduit wye



conduits feeding drain box for intensive green roof



INSTALLATION

Triangular Drainage Conduits are typically used with Conduit Wyes and Drain Boxes to create complete drainage networks. The conduits slide into the triangular knockouts on the sides of the drain boxes, creating an unobstructed flow pathway to roof drains. Layouts should be designed so that every point of the roof is within six feet (two conduit lengths) of a conduit.





FlexDrain

CT FlexDrain is a flexible, tough, dimpled polypropylene sheet that creates a permanent drainage and ventilation cavity on the exterior of roofs or walls. Adjacent sheets precisely overlap and interlock for gap-free coverage, and six-foot wide rolls minimize the number of seams.

For protected membrane (inverted) green roofs, FlexDrain is typically used in conjunction with CT Protection Mesh to protect rigid polystyrene insulation and preserve its thermal value. First Protection Mesh is applied over the insulation to structurally reinforce the insulation surface and prevent planting media from penetrating insulation seams; then FlexDrain is applied on top to provide drainage, ventilation, and mechanical protection. Although not a true root barrier, FlexDrain minimizes root penetration into insulation.

CT FlexDrain can be applied on the exterior of foundation walls to relieve hydraulic pressure, often eliminating the need for waterproofing.



Property	Test Method	US	Metric
Dry Weight (typical)	-	25 oz/yd ²	850 g/m ²
Thickness (typical)	-	5/16 in	8 mm
Water Retention (typical)	-	0.05 gal/ft ²	2.0 l/m ²
Saturated Density (typical)	-	0.6 lb/ft ²	2.9 kg/m ²
Flow Rate, i = 0.10 (250 psf = 12 kpa)	ASTM D4716	3.7 gal/min/ft	46 l/min/m
Compressive Strength (typical)	ASTM D1621	6700 lb/ft ²	32700 kg/m ²
Roll Dimensions (typical)	-	6 ft x 50 ft	1.8 m x 15.3 m
Roll Surface Area (typical)	-	300 ft ²	27.8 m ²
Roll Weight (typical)	-	52 lb	24 kg

PHYSICAL CHARACTERISTICS

(allow 10% additional material for overlaps)

INSTALLATION

Rolls of CT FlexDrain should be protected from sunlight when stored for any length of time.

CT FlexDrain is rolled with the dimples facing outward for rapid installation. Overlap two rows of dimples at all seams. To seal the seams, apply 1-1/2" wide butyl seam tape centered over the fourth row of dimples from the edge without a flange, overlap the tape with the flange of the next sheet, and apply firm pressure with a seam roller.

For inverted green roofs, first unroll CT Protection Mesh over the insulation, overlapping adjacent sheets approximately six inches. Then apply Flex Drain directly over the mesh with the dimpled side facing downward.

For walls, mechanically attach the second row from the top after carefully positioning the sheet so that the dimples overlap with the sheet below.



GREEN ROOF GEOTEXTILES

Conservation Technology offers a wide range of technical geotextiles optimized for green roofs including:

• separation fabrics with a three-dimensional surface structure that is highly resistant to clogging, and with an internal pore structure that retains green roof media without restricting root penetration or water drainage

• protection mats optimized for puncture resistance, water storage, and capillarity

• composite drainage mats designed to provide controlled drainage under long-term loading

All geotextiles are supplied individually bagged in easyto-handle roll sizes. Every roll is electrically scanned for metal debris and broken punching needles.

SELECTING GREEN ROOF GEOTEXTILES



Drainage Plate Systems: In this type of green roof, a waffled or dimpled plastic sheet serves as the primary drainage mechanism. Place *Separation Fabric HD* (6 oz/yd²) above the sheet drain to retain planting media while allowing water to drain freely. Place *Protection Mat* below the sheet drain to protect the underlying root barrier or waterproofing from mechanical damage and to retain water to reduce stormwater runoff. To enhance water storage for plants and to reduce stormwater runoff, substitute *Water Storage Mat* for *Protection Mat*.

Drainage Media Systems: In this type of green roof, a coarse lightweight inorganic granular media serves as the primary drainage mechanism, often supplemented by slotted drainage channels. Place *Separation Fabric SD* (4 oz/yd²) above the granular media to retain planting media while allowing water to drain freely. Place *Capillary Mat* below the granular media to protect the underlying root barrier or waterproofing from mechanical damage and to retain water that can be later utilized by the green roof plants by direct root contact and by vapor diffusion. The unique properties of *Capillary Mat* will also distribute the water evenly, eliminating problems caused by standing water or by uneven irrigation. To enhance water storage for plants and to reduce stormwater runoff, use *Water Storage Mat* instead of or in conjunction with *Capillary Mat*.

Drainage Mat Systems: In this type of green roof, a composite mat serves as the primary drainage mechanism. *Drainage Mat* is a two-layer composite consisting of a top layer of Separation Fabric that retains planting media while allowing water to drain freely into a coarse-fiber drainage layer below. *Protection Mat* is placed below this composite mat to protect the underlying root barrier or waterproofing from mechanical damage and to retain water that can be later utilized by the green roof plants by direct root contact and by vapor diffusion. *Capillary Drainage Mat* is a three-layer composite with Capillary Mat at the bottom of the coarse-fiber drainage layer, replacing the protection mat while providing better mechanical and hydraulic properties.

Conservation Technology Geotextile	Mechanical Strength	Water Retention	Capillary Rise	Internal Flow	Cross Flow
Separation Fabrics	low	low	low	low	high
Protection Mat	moderate	moderate	moderate	low	low
Capillary Mat	high	moderate	high	low	low
Water Storage Mat	high	high	moderate	low	low
Drainage Mat	low	low	low	high	high
Capillary Drainage Mat	high	moderate	high	high	low



SEPARATION FABRIC

Separation Fabric is a porous, synthetic geotextile made from a mechanically-consolidated, needle-punched blend of polypropylene and polyester fibers. Unlike most filter fabrics, it achieves mechanical strength without heat treatment and retains an open, three-dimensional surface structure that is highly resistant to clogging. The internal pore size distribution is carefully controlled to retain green roof planting media without restricting root penetration or water drainage. All rolls are electrically scanned for metal debris and broken punching needles.

Separation Fabric is available in two weights: the standard duty (SD) 4 oz/yd² is typically used over granular drainage media, and the heavy duty (HD) 6 oz/yd² is typically used over plastic sheet drains and at gravel perimeters where higher strength is required.



PHYSICAL CHARACTERISTICS

Property	Test Method	SD (US)	SD (metric)	HD (US)	HD (metric)
Dry Weight (typical)	ASTM D5261	4 oz/yd ²	135 g/m ²	6 oz/yd ²	200 g/m ²
Thickness (typical)	ASTM D5199	3/32 in	2mm	1/8 in	3mm
Static Puncture CBR (marv)	ASTM D6241	120 lb	550 N	290 lb	1290 N
Pin Puncture (marv)	ASTM D4833	20 lb	90 N	55 lb	250 N
Elongation (marv)	ASTM D4632	50%	50%	50%	50%
Grab Tensile (marv)	ASTM D4632	70 lb	300 N	90 lb	400 N
Trapezoidal Tear (marv)	ASTM D4533	30 lb	130 N	40 lb	170 N
Flow Rate (marv)	ASTM D4491	200 gpm/ft ²	70 lpm/m ²	200 gpm/ft ²	70 lpm/m ²
Permittivity (marv)	ASTM D4491	2.5 sec ⁻¹	2.5 sec ⁻¹	2.5 sec ⁻¹	2.5 sec ⁻¹
Mean Pore Size (typical)	ASTM F316	140 mesh	100 <i>µ</i>	140 mesh	100 <i>µ</i>
Bubble Point (typical)	ASTM D6767	70 mesh	220 µ	70 mesh	220 µ
O90 (typical)	ISO-12956	140 mesh	110 <i>µ</i>	140 mesh	110 <i>µ</i>
Roll Dimensions (typical)	-	6 ft x 100 ft	1.8 m x 30.5m	6 ft x 100 ft	1.8 m x 30.5m
Roll Surface Area (typical)	-	600 ft ²	56 m ²	600 ft ²	56 m ²
Roll Weight (typical)	-	17 lb	8 kg	25 lb	12 kg

(marv = minimum average roll value; allow 10-15% additional material for overlaps)

INSTALLATION

Since Separation Fabric becomes heavy when saturated with water, all rolls are shipped individually wrapped in waterproof plastic bags. Store the rolls in a dry location or under a waterproof tarp.

Unroll CT Separation Fabric, overlapping adjacent sheets approximately six inches. Cut with a heavy-duty scissors or shears. Spray with water to prevent uplift during windy conditions. Do not place fabric over drainage openings in aluminum edge or drain access enclosures!



PROTECTION MESH

Protection Mesh is a thin, high-strength woven geotextile made from non-biodegradable monofilament polypropylene. Unlike typical green roof protection mats which are made of non-woven fibers, the woven mesh does not retain any water and is highly breathable. These characteristics make it ideal for use over rigid polystyrene insulation used in protected membrane (inverted) roofs where long-term contact with damp fabrics can result in loss of insulation thermal value.

For protected membrane green roofs it is also important to have a drainage and ventilation layer above the mesh to prevent insulation saturation. For green roof systems with drainage plates, Drainage Plate will drain the green roof above and protect the insulation below. For green roof systems with granular media drainage, FlexDrain will retain water in the Capillary Mat above and protect the insulation below.



PHYSICAL CHARACTERISTICS

Property	Test Method	US	Metric
Dry Weight (typical)	ASTM D5261	6 oz/yd²	200 g/m ²
Thickness (typical)	ASTM D5729	1/64 in	0.4 mm
Water Retention (marv)	ASTM E2398	0.002 gal/ft ²	0.08 l/m ²
Saturated Density (marv)	ASTM E2398	0.06 lb/ft ²	290 g/m ²
Flow Rate (marv)	ASTM D4491	18 gpm/ft ²	6 lpm/m ²
Permittivity (marv)	ASTM D4491	0.3 sec ⁻¹	0.3 sec ⁻¹
Apparent Opening Size (typical)	ASTM D4491	70 mesh	210 <i>µ</i>
Static Puncture CBR (marv)	ASTM D6241	950 lb	4200 N
Elongation (marv)	ASTM D4632	15%	15%
Grab Tensile (marv)	ASTM D4632	250 lb	1100 N
Trapezoidal Tear (marv)	ASTM D4533	60 lb	270 N
Roll Dimensions (typical)	-	6 ft x 150 ft	1.8 m x 30.5 m
Roll Surface Area (typical)	-	900 ft ²	56 m²
Roll Weight (typical)	-	50 lb	23kg

(marv = minimum average roll value; allow 10-15% additional material for overlaps)

INSTALLATION

Rolls of Protection Mesh should be protected from sunlight when stored for any length of time.

Unroll Protection Mesh over the insulation, overlapping adjacent sheets approximately six inches. Cut with a heavyduty shears or with a utility knife. Then apply Drainage Plates or Flex Drain directly over the mesh with the dimpled side facing downward.



PROTECTION MAT

Protection Mat is a thick, multi-purpose geotextile protection mat made from mechanically consolidated, needle punched, 100% recycled polyester fibers. It offers puncture resistance, water storage, and capillarity at a very economical price.

Protection Mat is typically used as the bottom of a green roof system to protect the underlying waterproofing or root barrier from damage during green roof installation or maintenance. Although it is most commonly used under drainage plates or other sheet drainage materials, it's water-retention and capillary properties also make it suitable for use with granular media drainage systems.

All rolls are electrically scanned for metal debris and broken punching needles.



PHYSICAL CHARACTERISTICS

Property	Test Method	US	Metric
Dry Weight (typical)	ASTM D5261	16 oz/yd ²	540 g/m²
Thickness (typical)	ASTM D5729	1/8 in	3.5 mm
Water Retention (marv)	ASTM E2398	0.08 gal/ft ²	3.0 l/m ²
Saturated Density (marv)	ASTM E2398	0.7 lb/ft ²	3.5 kg/m ²
Capillary Rise (marv after 24 hours)	conductivity probe	2.5 in	65 mm
Static Puncture CBR (marv)	ASTM D6241	590 lb	2600 N
Pin Puncture (marv)	ASTM D4833	160 lb	700 N
Elongation (marv)	ASTM D4632	50%	50%
Grab Tensile (marv)	ASTM D4632	170 lb	750 N
Trapezoidal Tear (marv)	ASTM D4533	70 lb	300 N
Roll Dimensions (typical)	-	6 ft x 66.7 ft	1.8 m x 20.4 m
Roll Surface Area (typical)	-	400 ft ²	37 m²
Roll Weight (typical)	-	45 lb	20kg

(marv = minimum average roll value; allow 10-15% additional material for overlaps)

INSTALLATION

Since Protection Mat becomes very heavy when saturated with water, all rolls are shipped individually wrapped in waterproof plastic bags. Store the rolls in a dry location or under a waterproof tarp.

Unroll Protection Mat in any direction, overlapping adjacent sheets approximately six inches. Cut with a heavy-duty shears or with a utility knife. Spray with water to prevent uplift during windy conditions. Apply drainage plates or granular media directly over the mat.

For uniform green roof irrigation with granular drainage or single-layer green roof systems, install drip tubing directly over Protection Mat. The mat's capillarity will wick water in all directions.



CAPILLARY MAT

Capillary Mat is a thick geotextile mat made from mechanically consolidated, needle punched, fine-denier, polyester fibers. It offers exceptional water storage capacity, superior to that of many dimpled plastic drainage sheets, and it wicks water vertically in excess of 6.5". It also has extraordinary mechanical strength and puncture resistance.

The unique combination of water retention, capillarity, and mechanical strength makes Capillary Mat ideal for use on low-slope green roofs with granular media or entangled fiber drainage, as well as for all green roofs with steeper slopes. Its extraordinarily dense structure assures that it will not compress under long-term loading and will retain its hydraulic properties. All rolls are electrically scanned for metal debris and broken punching needles.



PHYSICAL CHARACTERISTICS

Property	Test Method	US	Metric
Dry Weight (typical)	ASTM D5261	28 oz/yd ²	950 g/m²
Thickness (typical)	ASTM D5729	3/16 in	5 mm
Water Retention (marv)	ASTM E2398	0.1 gal/ft ²	4.2 l/m ²
Saturated Density (marv)	ASTM E2398	1.1 lb/ft ²	5.2 kg/m ²
Capillary Rise (typical after 24 hours)	conductivity probe	6.5 in	165 mm
Static Puncture CBR (marv)	ASTM D6241	1120 lb	5000 N
Pin Puncture (marv)	ASTM D4833	280 lb	1250 N
Elongation (marv)	ASTM D4632	50%	50%
Grab Tensile (marv)	ASTM D4632	560 lb	2500 N
Trapezoidal Tear (marv)	ASTM D4533	200 lb	900 N
Roll Dimensions (typical)	-	6 ft x 50 ft	1.8 m x 15.3 m
Roll Area (typical)	-	300 ft ²	28 m ²
Roll Weight (typical)	-	60 lb	27kg

(marv = minimum average roll value; allow 10-15% additional material for overlaps)

INSTALLATION

Since Capillary Mat becomes very heavy when saturated with water, all rolls are shipped individually wrapped in waterproof plastic bags. Store the rolls in a dry location or under a waterproof tarp.

Unroll Capillary Mat, overlapping adjacent sheets approximately six inches. Cut with a heavy-duty shears or with a utility knife. Spray with water to prevent uplift during windy conditions. Apply granular drainage media or planting media directly over the mat.

For uniform green roof irrigation with granular drainage or single-layer green roof systems, install drip tubing directly over Capillary Mat. The mat's capillarity will wick water in all directions, including up slopes.



WATER STORAGE MAT

Water Storage Mat is a super-thick, geotextile mat made from mechanically consolidated, needle punched, 100% recycled polyester fibers. It offers exceptional water storage capacity, superior mechanical strength, and moderate capillarity.

Water Storage Mat can be used under low-slope green roofs to enhance water retention and provide uniform water distribution. Since three layers of Water Storage Mat will retain approximately one inch of rainfall, it can also be covered with a gravel ballast to create nonvegetated roofs that reduce and delay stormwater runoff ("blue roofs"). The dense structure of the mat assures that it will not compress under long-term loading and will retain its hydraulic properties. All rolls are electrically scanned for metal debris and broken punching needles.



PHYSICAL CHARACTERISTICS

Property	Test Method	US	Metric
Dry Weight (typical)	ASTM D5261	36 oz/yd ²	1200 g/m ²
Thickness (typical)	ASTM D5729	5/16 in	8.0 mm
Water Retention (marv)	ASTM E2398	0.18 gal/ft ²	7.2 l/m ²
Saturated Density (marv)	ASTM E2398	1.7 lb/ft ²	8.4 kg/m ²
Capillary Rise (marv after 24 hours)	conductivity probe	2.5 in	65 mm
Static Puncture CBR (marv)	ASTM D6241	1530 lb	6800 N
Pin Puncture (marv)	ASTM D4833	310 lb	1400 N
Elongation (marv)	ASTM D4632	50%	50%
Grab Tensile (marv)	ASTM D4632	450 lb	2000 N
Trapezoidal Tear (marv)	ASTM D4533	210 lb	925 N
Roll Dimensions (typical)	-	6 ft x 33.3 ft	1.8 m x 10.2 m
Roll Surface Area (typical)	-	200 ft ²	19 m ²
Roll Weight (typical)	-	45 lb	20 kg

(marv = minimum average roll value; allow 10-15% coverage loss for overlaps)

INSTALLATION

Since Water Storage Mat becomes very heavy when saturated with water, all rolls are shipped individually wrapped in waterproof plastic bags. Store the rolls in a dry location or under a waterproof tarp.

Unroll Water Storage Mat, overlapping adjacent sheets approximately six inches. Cut with a heavy-duty shears or with a utility knife. Spray with water to prevent uplift during windy conditions. Apply drainage plates or granular media directly over the mat.

For uniform green roof irrigation with granular drainage or single-layer green roof systems, install drip tubing directly over Water Storage Mat. The mat's capillarity will wick water in all directions.



DRAINAGE MAT

Drainage Mat is a thermally-bonded laminate of two geotextiles. The top layer is a separation fabric with inter-fiber spaces carefully controlled to retain green roof planting media while allowing unrestricted root penetration and water drainage. The lower layer is a coarse-fiber mat with large inter-fiber spaces that provide controlled lateral water flow.

Drainage Mat is optimized for sloped green roofs that require just enough drainage to prevent waterlogged root systems without creating excessive drying. It can be used to partially cover Protection Mat, Capillary Mat, or Water Storage Mat in locations prone to excess water accumulation, such as near roof drains and edges. Its dense structure assures that it will will retain its hydraulic properties under long-term loading. All rolls are electrically scanned for metal debris.



PHYSICAL CHARACTERISTICS

Property	Test Method	US	Metric
Dry Weight (typical)	ASTM D5261	24 oz/yd ²	800 g/m²
Thickness (typical)	ASTM D5729	5/16 in	8 mm
Water Retention (marv)	ASTM E2398	0.17 gal/ft ²	6.7 l/m ²
Saturated Density (marv)	ASTM E2398	1.5 lb/ft ²	7.5 kg/m ²
Static Puncture CBR (marv)	ASTM D6241	160 lb	720 N
Pin Puncture (marv)	ASTM D4833	20 lb	100 N
Elongation (marv)	ASTM D4632	50%	50%
Grab Tensile (marv)	ASTM D4632	70 lb	330 N
Trapezoidal Tear (marv)	ASTM D4533	30 lb	130 N
Flow Rate, i = 0.02 (250 psf = 12 kpa)	ASTM D4716	0.03 gal/min/ft	0.4 l/min/m
Flow Rate, i = 0.05 (250 psf = 12 kpa)	ASTM D4716	0.08 gal/min/ft	1.0 l/min/m
Flow Rate, i = 0.10 (250 psf = 12 kpa)	ASTM D4716	0.15 gal/min/ft	2.0 l/min/m
Flow Rate, i = 0.25 (250 psf = 12 kpa)	ASTM D4716	0.36 gal/min/ft	4.8 l/min/m
Flow Rate, i = 0.33 (250 psf = 12 kpa)	ASTM D4716	0.47 gal/min/ft	5.8 l/min/m
Flow Rate, i = 0.50 (250 psf = 12 kpa)	ASTM D4716	0.68 gal/min/ft	8.4 l/min/m
Flow Rate, i = 0.75 (250 psf = 12 kpa)	ASTM D4716	0.96 gal/min/ft	11.9 l/min/m
Flow Rate, i = 1.00 (250 psf = 12 kpa)	ASTM D4716	1.20 gal/min/ft	15.7 l/min/m
Roll Dimensions (typical)	-	6 ft x 33.3 ft	1.8 m x 10.2 m
Roll Surface Area (typical)	-	200 ft ²	18.6 m ²
Roll Weight (typical)	-	33 lb	15 kg

(marv = minimum average roll value; allow 10-15% additional material for overlaps)



CAPILLARY DRAINAGE MAT

Capillary Drainage Mat is a thermally-bonded laminate of three geotextiles. The top layer is a separation fabric with inter-fiber spaces carefully controlled to retain green roof planting media while allowing unrestricted root penetration and water drainage. The middle layer is a coarse-fiber mat with large inter-fiber spaces that provide controlled lateral water flow. The bottom layer is a capillary mat with exceptional water storage capacity that can wick water vertically in excess of 6.5". This composite also provides extraordinary mechanical strength and puncture resistance.

Capillary Drainage Mat is optimized for sloped green roofs that require high water retention and limited drainage. Its dense structure assures that it will will retain its hydraulic properties under long-term loading. All rolls are electrically scanned for metal debris.



PHYSICAL CHARACTERISTICS

Property	Test Method	US	Metric
Dry Weight (typical)	ASTM D5261	50 oz/yd ²	1700 g/m²
Thickness (typical)	ASTM D5729	7/16 in	11 mm
Water Retention (marv)	ASTM E2398	0.23 gal/ft ²	9.2 l/m ²
Saturated Density (marv)	ASTM E2398	2.2 lb/ft ²	10.9 kg/m ²
Capillary Rise (typical, after 24 hours)	conductivity probe	6 in	155 mm
Static Puncture CBR (marv)	ASTM D6241	> 2250 lb	> 10,000 N
Pin Puncture (marv)	ASTM D4833	290 lb	1300 N
Elongation (marv)	ASTM D4632	55%	55%
Grab Tensile (marv)	ASTM D4632	850 lb	3800 N
Trapezoidal Tear (marv)	ASTM D4533	310 lb	1400 N
Flow Rate, i = 0.02 (250 psf = 12 kpa)	ASTM D4716	0.03 gal/min/ft	0.4 l/min/m
Flow Rate, i = 0.05 (250 psf = 12 kpa)	ASTM D4716	0.08 gal/min/ft	1.0 l/min/m
Flow Rate, i = 0.10 (250 psf = 12 kpa)	ASTM D4716	0.15 gal/min/ft	2.0 l/min/m
Flow Rate, i = 0.25 (250 psf = 12 kpa)	ASTM D4716	0.36 gal/min/ft	4.8 l/min/m
Flow Rate, i = 0.33 (250 psf = 12 kpa)	ASTM D4716	0.47 gal/min/ft	5.8 l/min/m
Flow Rate, i = 0.50 (250 psf = 12 kpa)	ASTM D4716	0.68 gal/min/ft	8.4 l/min/m
Flow Rate, i = 0.75 (250 psf = 12 kpa)	ASTM D4716	0.96 gal/min/ft	11.9 l/min/m
Flow Rate, i = 1.00 (250 psf = 12 kpa)	ASTM D4716	1.20 gal/min/ft	15.7 l/min/m
Roll Dimensions (typical)	-	6 ft x 33.3 ft	1.8 m x 10.2 m
Roll Surface Area (typical)	-	200 ft ²	18.6 m ²
Roll Weight (typical)	-	70 lb	32 kg

(marv = minimum average roll value; allow 10-15% additional material for overlaps)



DRAINAGE MAT HYDRAULIC FLOW CHARACTERISTICS

The following chart can be used to determine the drainage capacity of Drainage Mat or Capillary Drainage Mat. The roof slope is used to determine the "rain factor" which is the rain intensity measured in inches per hour that can flow through a one-foot wide section of the mat. Dividing this number by the length of the roof slope yields the rain intensity falling on each square foot of roof that can drain effectively. For example, if the roof slope is 3:12 the rain factor is slightly less than 35 inches per hour per foot, so if the length along the roof slope measures 25 feet, the mat can effectively drain 35/25 = 1.4 inches per hour. This flow rate is very conservative because it is measured at a compression of 250 lb/sf, roughly ten times the weight of a typical sloped green roof, and it does not account for the substantial water holding capacity of the planting media and capillary mat.



INSTALLATION

All rolls of Drainage Mat or Capillary Drainage Mat are shipped individually wrapped in waterproof plastic bags. Store the rolls in a dry location or under a waterproof tarp.

Unroll either mat in the direction of water flow; then cut with a heavy-duty shears or a utility knife. Optimally, a single sheet of mat should run from the high side of the roof to the low side of the roof. If more than one sheet must be used in this direction, overlap the upper sheet over the lower sheet approximately six inches. Adjacent sheets of mat should also be lapped approximately six inches. Spray with water to prevent uplift during windy conditions. When required, the *Mesh and Cleat Slope Stabilization System* should be laid over the mat with drip irrigation tubing tied to the mesh.



ALUMINUM EDGE

The *Aluminum Edge* securely retains green roof planting media at roof edges and separates planting media from gravel, decks, or pavers. It is precision fabricated from 63 mil high-strength, corrosion-resistant, tempered aluminum alloy formed into a shape that offers greater structural strength than thicker flat sheets or extrusions. Stock sizes are 3", 4", 6", and 8" tall by 72" long.

Slots in the vertical face are designed to provide unrestricted water drainage in the critical first inch off the roof while retaining virtually all green roof planting media. Large holes in the base permit penetration-free fastening to underlying waterproofing, root barriers, or geotextiles. Wide bases resist rollover, and optional diagonal braces are available to minimize bending under heavy soil loading. Prefabricated internal and external fittings provide strong, attractive corners. A unique connector also slides into the folds of both the lineals and corners, locking into the vertical slots to provide tight joints that allow thermal movement.



LINEALS





LOCKING CONNECTORS

Lengths of Aluminum Edge are invisibly joined by sliding the unique *Locking Connector* into the inverted J-fold in the vertical face and the U-fold in the base. Tabs in the connector snap into the slots in the vertical face, locking the adjacent edges without preventing thermal expansion and contraction. The connector has vertical and horizontal slots precisely punched to match the slots in the metal edge, so the drainage and fastening slots are not blocked. The length (L) of all connectors is 7" (175mm); the height (H) and base (B) dimensions match the corresponding dimensions for lineals.



DIAGONAL BRACES

Although the design of Aluminum Edge provides exceptional strength and stiffness, bending in unavoidable when the pressure on one side of the vertical leg is significantly higher than the pressure on the other side of the leg, for example the low side of a sloped roof. Sliding a *Diagonal Brace* into the folds of the aluminum edge largely eliminates this bending. In most cases it is sufficient to locate one brace 18" from each end of each aluminum edge. No fasteners are required. The height (H) and base (B) dimensions match the corresponding dimensions for lineals.







INTERNAL-FLANGE CORNERS

Prefabricated Internal Flange Corners precisely match the lineals and are joined with the same invisible locking connectors. They are extremely rigid and have the same large oval slots in the base as the metal edge that allow fastening to underlying waterproofing without penetrations. These features make them ideal for outside corners of both flat and sloped green roofs without structural parapets or curbs to retaining planting media. They are also ideal for for boundary separators between planted areas and pavers where aluminum movement can be problematic. Other applications include custom drain enclosures and planter edges.



top view



Height (H)	Base (B)	Leg (L)
3" (100mm)	5" (150mm)	12" (300mm)
4" (100mm)	6" (150mm)	12" (300mm)
6" (150mm)	8" (200mm)	16" (400mm)
8" (200mm)	12" (300mm)	16" (400mm)

interior view







EXTERNAL-FLANGE CORNERS

Prefabricated *External Flange Corners* precisely match the lineals and are joined with the same invisible locking connectors. They are extremely rigid and have the same large oval slots in the base as the metal edge that allow fastening to underlying waterproofing without penetrations. These features make them ideal for outside corners of both flat and sloped green roofs without structural parapets or curbs to retaining planting media. They are also ideal for for boundary separators between planted areas and pavers where aluminum movement can be problematic. Other applications include custom drain enclosures and planter edges.





	↓ L →	
 H		

Height (H)	Base (B)	Leg (L)
3" (100mm)	5" (150mm)	12" (300mm)
4" (100mm)	6" (150mm)	12" (300mm)
6" (150mm)	8" (200mm)	16" (400mm)
8" (200mm)	12" (300mm)	16" (400mm)





SLOPE-STABILIZATION SYSTEM

When roof slopes exceed 2:12 or 10°, green roof media can float and slide down the roof during periods of heavy rainfall. Anti-Slip Cleats attached to Anti-Slip Mesh retain the media, creating an effective slope stabilization system that does not require penetrating roof waterproofing.

For gabled or barrel-shaped roofs with two equal and opposite sides, the mesh is laid continuously from one eave to the opposite eave so that the downward sliding forces on one side of the roof balance the downward sliding forces on the other side. For shed roofs the mesh must be mechanically fastened with a structural clamping system at the top of the roof. Anti-Slip Cleats made of black recycled ABS plastic are fastened to the Anti-Slip Mesh to create rows spaced 10" to 50" apart that transfer soil loads to the mesh.





INSTALLATION

Clip the cleats onto the mesh creating rows spaced as indicated in the chart. To distribute load on the mesh, shift each row one-quarter cleat from the row above and below. Insert extra cleats between rows at edges to fill the voids created by shifting rows.

Roof Slope	Row Spacing
3:12	50"
4:12	40"
5:12	30"
6:12	20"
7:12	10"



PEDESTALS

Pedestals are used to elevate rooftop pavers or decks to match the height of surrounding roof gardens or interior floors, to provide a drainage pathway, or to create a space for water pipes and electrical conduit. Unfortunately, installing most pedestal systems is a labor-intensive process requiring the installer to set slope-compensation discs and precisely adjust the height of each pedestal before placing the surfacing.

Our pedestals significantly speed installation by eliminating the need to pre-set for slopes or pre-adjust heights. The pedestals are simply set to the approximate height, the pavers or deck sections are placed, and the pedestal heights are adjusted with a special tool that fits through the gaps between pavers. The pedestal heads tilt to automatically compensate for slopes up to 5°. With the appropriate base, top, and extensions, the system can accommodate any height from 1-1/8" and 21-3/4".





COMPONENTS

TО

B0

Pedestals are normally supplied as kits consisting of a flanged base, a threaded top, plus one or more extensions if required. The height is determined by subtracting the paver thickness from the overall height measured from the roof surface to the top of the pavers. Kits 0, 1, and 2 consist of bases B0, B1, and B2 with corresponding tops T0, T1, and T2 and yield heights from 1-1/8" to 3". Kits 3, 4, and 5 consist of base T3 with tops T3, T4, and T5 and yield heights from 3" to 8-1/2". Kits 6 through 14 also consist of base B3 with tops T3, T4, and T5 but add one, two, or three threaded extensions in between to reach heights up to 21-3/4".

Τ1

Β1







Conservation Technology



ΤЗ



B3

Kit ID	Minimum	Maximum	Base ID	Top ID	Extensions
0	1-1/8"	1-1/2"	В0	TO	0
1	1-1/2"	2"	B1	T1	0
2	2"	3"	B2	T2	0
3	3"	4-3/4"	B3	Т3	0
4	4-3/4"	6-3/4"	B3	T4	0
5	6-3/4"	8-1/2"	B3	T5	0
6	5-1/2"	9"	B3	Т3	1
7	7-1/4"	10-3/4"	B3	T4	1
8	9-1/4"	12-3/4"	B3	T5	1
9	8"	13-1/2"	B3	Т3	2
10	9-3/4"	15"	B3	T4	2
11	11-3/4"	15-3/4"	B3	T5	2
12	10-1/2"	18"	B3	Т3	3
13	12-1/4"	19-3/4"	B3	T4	3
14	14-1/4"	21-3/4"	B3	T5	3

T2

B2



ROOT BARRIER

Root Barrier is a 30 mil (0.030") thick plastic sheet designed to protect waterproofing membranes from damage by green roof plants. Made from linear-lowdensity polyethylene (LLDPE), it provides exceptional flexibility, tear strength, and puncture resistance. It is highly resistant to environmental stresses on green roofs including air pollution, summer heat, and winter cold, and does not contain any recycled resins or plasticizers that can lead to premature aging or plant toxicity.

Standard roll sizes are 10 ft x 50 ft and are supplied as a 6 ft long roll for easily handling by one person. For safe shipping and storage, rolls have a sturdy core and are covered with a protective wrapper. Other sizes and thicknesses are available on special order.



Property	Test Method	US	Metric
Thickness (typical)	ASTM D5199	0.030 in	0.75 mm
Density (maximum)	ASTM D792	0.14 lb/ft ²	0.7 kg/m ²
Tensile Strength at Break (marv)	ASTM D6693	125 lb/in	22 N/mm
Elongation at Break (marv)	ASTM D6693	800%	800%
Pin Puncture (marv)	ASTM D4833	45 lb	200 N
Tear Resistance (marv)	ASTM D1004	16 lb	71 N
Oxidative Induction Time (marv)	ASTM D3895	> 100 min	> 100 min
Oven Ageing, 85°C for 90 Days	ASTM D5271	pass	pass
UV Resistance, 1600 Hours	GRI GM11	pass	pass
Low Temperature Impact (typical)	ASTM D746	< 70° C	< 70° C
Dimensional Stability (typical)	ASTM D1204	< 2%	< 2%
Environmental Stress Cracking (marv)	ASTM D5397	>400 hr	> 400 hr
Vapor Permeability (typical)	ASTM E96	0.029 gr/ft ² /hr/in	0.019 g/m²/day/mm
Roll Size (typical)	-	10 ft x 50 ft	3.1m x 15.3m

PHYSICAL CHARACTERISTICS

(marv = minimum average roll value; allow 10-15% additional material for overlaps)

INSTALLATION

Rolls are shipped individually wrapped with a sunlight-resistant, waterproof, protective plastic wrapper. Store the rolls in a dry location or under a waterproof tarp. Minimize field seaming with careful layout. Unroll Root Barrier in any direction, unfold, drag into position, and overlap with the adjacent sheet. For optimal performance, sheets should be welded with a hot-air or heated-wedge seamer, in which case a six-inch overlap will suffice. If welding is not feasible, overlap sheets approximately three feet and use our *Root Barrier Tape* under the upper edge of the overlap.

						Vstens Vstens Value
grasses G4	grasses G4 G4 Sector	grasses G4 grasses G4 sedum P0 P1 P1	grasses G4 grasses G4 Po Image: Comparison of the temperature of temperatu	grasses G4 Image: Constraint of the sector of the sec	grassesG4Image: Constraint of the sector of the sect	grassesG4Image: Constraint of the sector of the sect
	Name Name Name Name Name Name Name Name Name Name	PO P1	PO P1 P2	sedum P1 P2 P3 prennials P1	PO P1 P2 P3 P4	PO P1 P2 P3 P4 M0 Prennials grasses shrubs sedum
P1 P2 P3 P4 M0 M1 Perennials grasses sedum sedum	P2 P3 P4 M0 M1	P3 P4 M0 M1 boots	P4 M0 M1 Sedum	sedum M0 M1	sedum M1	