

MODULAR GREENROOF 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 water-retaining 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 continuous systems.



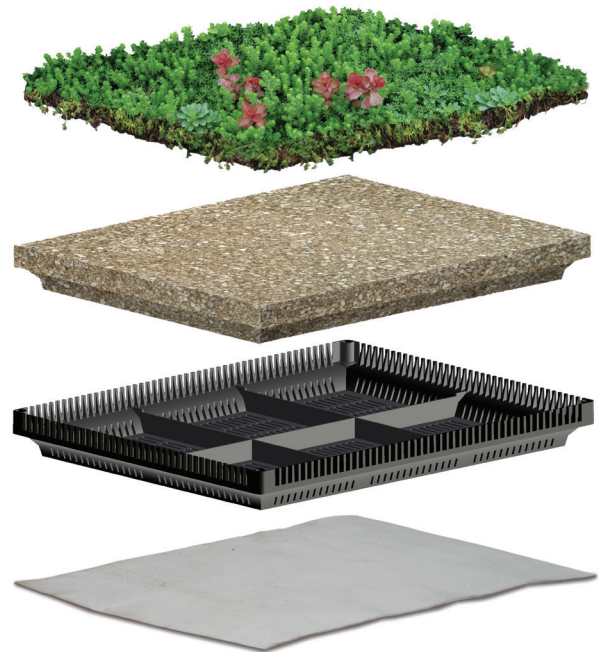
pre-planted module on capillary mat

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

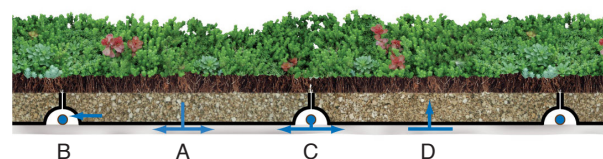
The trays are filled with the lightweight growing media, which is then compacted and stacked on pallets for shipping to the jobsite. On the rooftop, the modules are laid on capillary protection mat, a heavy-duty water-retaining geotextile that can distribute water in all directions. After installation,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



exploded view of system components

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).



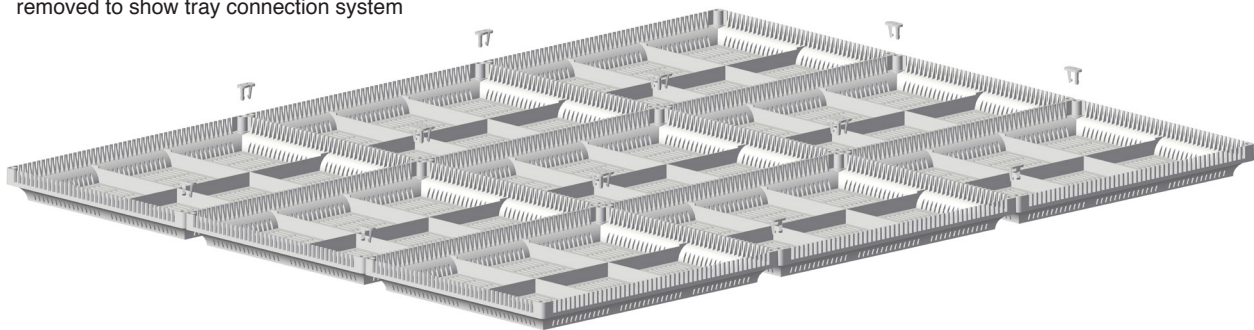
cross-section showing water flow

CONNECTING MODULES

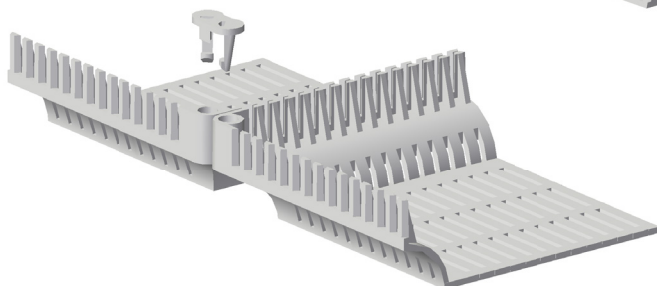
Adjacent modules are joined with plastic connectors that snap into holes at the corners of the trays: four-prong connectors are used in the center of the roof, and two-prong connectors are used at the edges. The holes that receive the connectors are open at the bottom, so any growth media or plant matter 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.



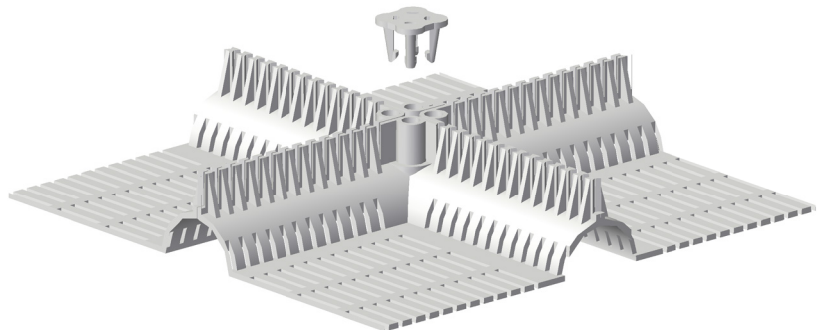
modules with plants and growing media removed to show tray connection system



two-prong edge connector at intersection of two trays

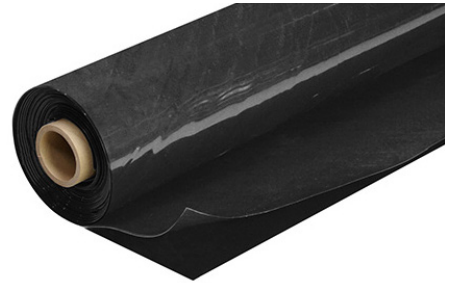


four-prong center connector at intersection of four trays



MODULAR SYSTEM COMPONENTS

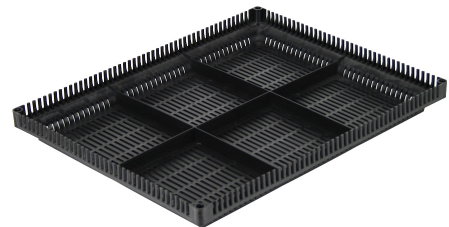
Root Barrier is a 30 mil (0.75mm) thick LLDPE sheet that provides exceptional resistance to root penetration, puncture, and tearing, yet offers good flexibility for ease of installation. It is highly resistant to environmental stresses on green roofs including air pollution, summer heat, and winter cold, 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/lyd² (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 polypropylene 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 square 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.

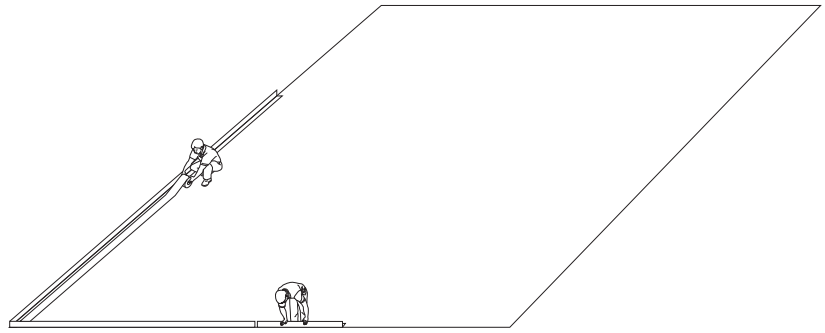


FlexDrain is a flexible, tough, dimpled polypropylene sheet that can be installed beneath the Capillary Mat to create a drainage and ventilation cavity. This allows stormwater from adjacent roof areas to flow under the modular system to reach drains. When the green roof is used over a protected membrane (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.

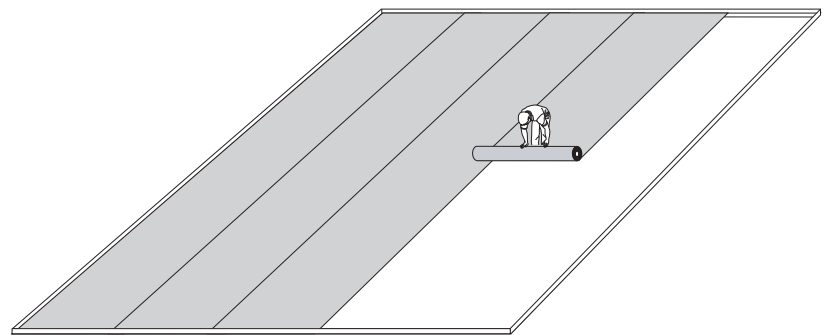


MODULAR SYSTEM INSTALLATION

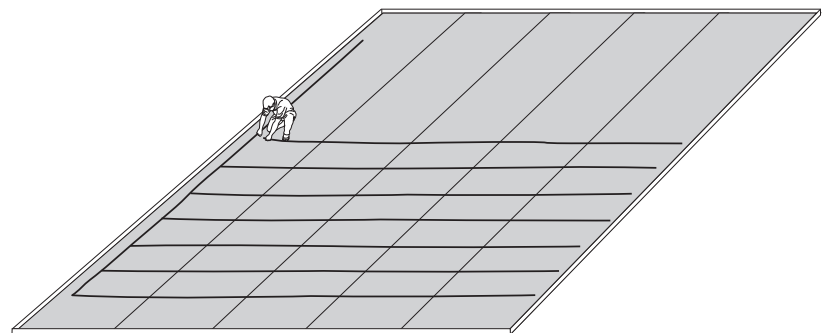
Install Aluminum Edge: Position Aluminum Edge near the roof edge and tape or weld it to the waterproofing membrane through the large holes in the base flange. Use fabricated corners for strength and join all parts with locking connectors. If the roof is surrounded by parapet walls, aluminum edge is not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



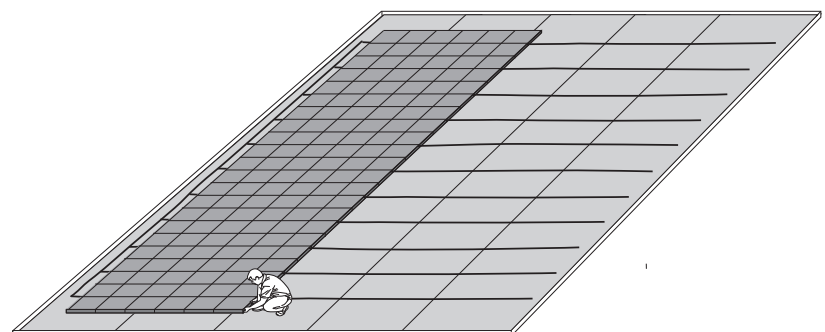
Lay root barrier and capillary mat: If the primary roof waterproofing is not root resistant, first apply Root Barrier, either welding or overlapping three feet with sealing tape in the overlap. Then unroll Capillary Mat, overlapping adjacent sheets at least six inches. The mat should fully cover the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



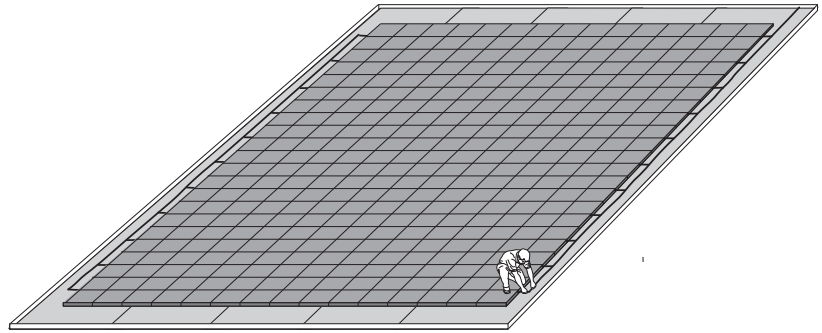
Place Drip Irrigation Tubing: Drip irrigation lines should be installed between every other tray. Cut the drip lines longer than required and create a header on one side using tee and elbow fittings to connect to plain drip tubing (without emitters).



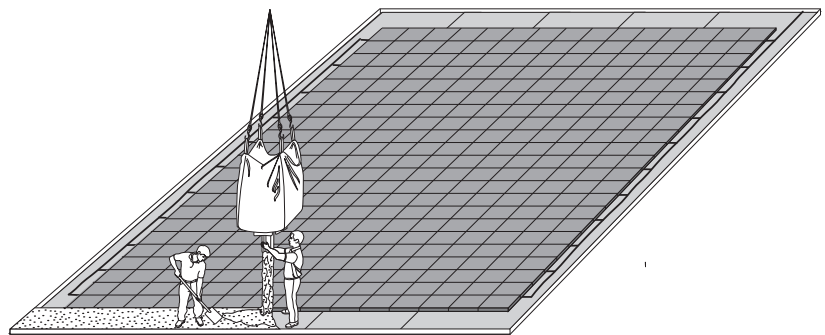
Begin Tray Installation: Starting at the end of the roof with the drip header, place trays tightly butted together. After each row is placed, insert tray connectors between the last two rows. If a connector does not seat fully, clean out the holes with a blunt, small diameter object such as a wood dowel. 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: Unroll sedum mats to cover the trays. The mat joints can fall anywhere – they do not need to line up with the tray edges. Water thoroughly after installation to fully saturate the mats and planting media; then water as needed to prevent excessive drying until the plants are fully established. Broadcast Intensive Roof Fertilizer twice yearly.

