

Installation Guide



Chapter 1 Introduction

The purpose of this manual is to ensure that the GreenGrid® Green Roof System is handled and installed correctly in accordance to Weston Solution's (WESTON) (manufacturer) quality standards. This manual does not replace a manufacturer's representative providing oversight; it is intended to assist those who elect not to purchase manufacturer oversight. The following sections cover system components and standard installation recommendations for a typical GreenGrid project.

Disclaimer:

Before installation of the modules, the waterproofing surface shall be inspected by a technical representative of the waterproofing installer/manufacturer or building Owner to determine the adequacy of the waterproofing surface (New or existing) to accept the modules. Also, it shall be the Owner's responsibility to determine the adequacy of the structure to support the existing and proposed loads.

Upon completion of the installation, an inspection shall be conducted by a GreenGrid Technical Representative or delegate to ascertain that the modules have been installed according to these specifications and details. This inspection is not intended to be a final inspection for the benefit of the owner but for the benefit of determining whether a warranty shall be issued.

The green roof modular components, growth media, vegetation, and other optional materials shall be purchased from Weston Solutions, Inc., through our Alliance partners, or a licensed distributor.

We hope that the following Installation Manual will serve you in your installation endeavors. At WESTON, we take pride in our product quality and customer service and we hope you as our installers take pride in a quality installation.

Thank you,
The GreenGrid® Team at Weston Solutions, Inc.

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U.S. Patents: 6,711,851 | 6,862,842 | 7,900,397 | 7,997,027 – Canadian Patents: 2,416,457 | 2,418,262 | 2,416,463 - Additional U.S. and international patents pending

Chapter 2 GREENGRID® PRODUCTS

Design Specifications

GreenGrid® Modules are formed of 182 mil (4.25-inch), 200 mil (6-inch), or 225 mil (8-inch) recycled (100% pre-consumer) High Molecular Weight Polyethylene (HMWPE) protected with UV inhibitors and stabilizers.

GreenGrid® Modules sizes (Module OD ± 0.125”):

Shallow (Extensive): 2’x 2’x 4.25” Depth

Intermediate (Semi-Intensive): 2’x 2’x 6” Depth

Maximum (Intensive): 2’x 2’x 8” Depth

GreenGrid® Module to be delivered to the project location complete with growth media, filter fabric, pre-vegetated (50% to 95 % coverage options) with plant species of the color and type desired by the client, suitable for a green roof application, and approved by WESTON.

GreenGrid® Module weights (Bulk density at maximum water holding capacity):

Shallow (Extensive) Depth System (4.25-inch): 26 to 30 lbs/sf

Intermediate (Semi-Intensive) Depth System (6-inch): 39 to 44 lbs/sf

Maximum (Intensive) Depth System (8-inch): 52 to 58 lbs/sf

GreenGrid® Module clearance above the roof is 0.75 inches.

Growth Media

GreenGrid® Growth Media is an engineered light weight blend consisting of inorganic and organic components. Formulations are based on the German FLL “Guidelines for Planning, Execution and Upkeep of Green-Roof Sites”

Vegetation

GreenGrid Pre-Vegetated Modules: GreenGrid® modules are to be filled with plant species desired by the client and suitable for vegetative roof applications. Plants are to be grown to various levels of maturity (outlined below) at the nursery prior to delivery and installation.

50% Coverage - Pre-Vegetated System (Base)

Plants are established in modules, but with limited growth. Lead times vary, but 50% coverage takes approximately 6 to 8 weeks depending on season and weather. This option gives you the best of both worlds; the cost effectiveness of minimal nursery growing coupled with a lesser upfront establishment maintenance.

80 % Coverage - Pre-Vegetated System

Plants established in modules and grown under nursery care for approximately 10 to 12 weeks. More or less a mature vegetated roof, but more cost competitive than the fully mature planting option.

95% Coverage - Fully Mature System

Plants are grown to full maturity (approx. 95%+ foliage coverage) under nursery care. Modules are grown out at our partner nurseries in accordance with the specification, delivered to the job site, and installed for an instant mature vegetated roof. In addition to the instant aesthetic appeal, fully grown-out modules provide other functional benefits: a mature vegetated roof is less susceptible to weed encroachment, and mature vegetation helps protect the growth media from potential wind scour and water erosion. This translates to a successful vegetated roof with less maintenance. Consult your GreenGrid® representative as lead times vary.

Sedum Mats – Fully Mature System

Sedum mats grown to full maturity can either be installed at the nursery prior to delivery or installed in concurrence with the modules on the rooftop.

GreenGrid® Accessories

Rubber Pavers (optional)

- Standard Paver size: 2 feet by 2 feet, and 1.75-inches in depth. Various paver depths are available.
- Pavers are composed of 100% recycled (post-consumer) rubber and are available in various colors.
- Standard Paver weight: 7.5 lbs. per square foot, minimum.

Ipé Wood Pavers (optional)

- Standard Paver size: 2 feet by 2 feet, and 1.5-inches in depth.
- Pavers are composed of Ipé Brazilian hardwood, sustainably harvested.
- Optional pedestal and shim system may be required depending on design and application.

Edge Treatments (optional)

- Standard Edge Treatment: 0.040 Coated Aluminum (recycled content 91%) or 24 gauge Coated Steel (recycled content 28 to 35%) for placement on viewable edge of modules. Variety of color templates available
- Bendable Edge Treatment is to be used on the cut side of modules to retain growth media and vegetation when custom cutting/fitting modules: 0.063 Aluminum (recycled content 91%)

Irrigation Systems (optional)

Irrigation requirements depend on project location and plant selection. For extensive GreenGrid systems planted with a mix of highly drought resistant ground covers, an irrigation system is generally not needed (exceptions do apply to some arid climates). However, WESTON strongly recommends a backup system to irrigate the green roof during prolonged droughts or during hot dry windy weather patterns. Simple overhead spray system with spray heads, or spigot/hose/sprinkler systems are inexpensive and effective methods. These also provide the means to optimize the evaporative cooling effect of the vegetative green roof during such weather events.

Chapter 3 JOB SPECIFIC RECOMMENDATIONS

General

The contractor shall furnish all labor, materials, tools, and equipment to unload, hoist and install the GreenGrid® Green Roof System provided by WESTON. The GreenGrid® System shall include modules, growth media and the vegetation as specified on drawings or as directed by the Project Engineer delivered to the project site. This work shall also include installation of edge treatments, rubber pavers, decorative ballast, slip-sheet, and an irrigation system, if specified. It is also recommended that the installer conducts a site visit prior to installation to familiarize themselves with onsite logistics and begin to plan for installation and necessary resources. This will aid in estimating labor and equipment needs to complete the GreenGrid® installation. The following points should be used as a guide in planning your GreenGrid Installation.

Crew Size and related Tasks:

- Job Foreman – primarily too direct labor on the project site (ground and roof operations)
- Two workers to unload truck and hoist modules to the roof surface (qualified crane/forklift operator and riggers)
- Four or more workers to transport and set modules on roof per the design
- One worker for ongoing cleanup and initial irrigation (by hand)
- Additional workers may be needed to operate crane if contractor owns hoisting equipment

Equipment:

- For unloading of the delivery truck(s) - Forklift, Skid-steer, or Crane
- To hoist to the roof surface - Crane, Extendable Reach Forklift (Lull), or Ladder-vator, etc.
- For material handling on roof surface – pneumatic tire roofing carts/dollies, etc

Staging Area:

- Establish a Staging Area with General Contractor or Building Owner
- Allocate enough space to unload a 53' tractor-trailer and stage pallets or cages hoisting
- Allocate a space to erect a Crane or a zone for the forklift to operate
- Reserve space for empty pallets or cages and shipping materials to be stockpiled for return to WESTON – preferably on a hard surface (concrete walk, asphalt, etc.)

Timing of Installation/Ordering:

- Seasonal availability:
 - Northern Climates: Unless otherwise permitted, module installation shall be done between April 15 and October 15, but not when the weather is below 50° F.

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- Southern Climates: Will be dependent upon weather and/or plant availability
- Contact your Weston GreenGrid Project Manager for specific information
- Once a signed authorization is received, mobilization will be initiated, materials will be ordered manufactured/propagated and shipped to the designated nursery facility, where assembly, planting, loading, and delivery sequences will begin.
- Order Notification: Order will be confirmed when a signed PO is received and contract terms have been agreed. WESTON to be notified as soon as feasible. To ensure your project delivery meets your schedule, the following are the minimum Order Lead Times:
 - Extensive System
 1. 50% coverage option – 8 to 10 weeks lead time
 2. 80% coverage option – 10 to 12 weeks lead time
 3. 95% coverage option – 12 to 14 weeks lead time
 - Semi-intensive and Intensive System – TBD [Contact your WESTON GreenGrid Project Manager for specific information]
- All delivery schedules are to be coordinated with your WESTON Project Manager. Please be advised however, as this is a living product, returned materials will be assessed a 75% restocking fee if returned shipped from the site. If the customer cancels the order or postpones delivery within five (5) business days of scheduled delivery, a fee will be assessed for demobilization/mobilization and no guarantees will be made on next delivery date.

Water Access

Installed modules shall be watered sufficiently with a fine spray on the day of installation to thoroughly moisten the growth media from top to bottom. Water shall be free of substances harmful to plant growth. Hoses or other methods of temporary irrigation shall be furnished by the Contractor

Personal Protective Equipment

Erect safety signage and provide fall protection/fall prevention apparatuses as required under OSHA. It is the responsibility of the installation contractor to ensure compliance of all applicable OSHA while working on the project site, lifting equipment and fall protection are followed.

Waterproofing Surface Protection:

- Proper protection of the waterproofing surface and recognition of roof loading limits in the hoisting area shall be considered and is the responsibility of the installation contractor taking delivery.
- Protect parapet walls from bumping and/or abrasions
- Thoroughly sweep away all debris, foreign material, etc. from the waterproofing surface.
- Refer to Waterproofing System manufactures' recommendation for acceptable slip-sheet materials to be placed under the GreenGrid modules and overlying the waterproofing membrane.

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- Plywood or foam insulation is recommended to be used in the ***“landing zone”*** to help protect roof surface from point loading. Never land pallets, cages, or other shipping containers directly on the waterproofing surface
- Throughout the installation, constantly sweep up debris as it occurs. Do not install GreenGrid modules, pavers, or edge treatment over gravel, debris, etc. as this could damage the waterproofing surface.
- Do not install modules on saturated roof surfaces or under freezing weather conditions
- If damage to the waterproofing surface occurs, stop the installation process immediately and contact the roofing contractor for repair. Never install the system over any damaged or defected waterproofing surface.

Chapter 4 INSTALLATION PROCESS

GENERAL

There are no green roof projects that are exactly the same. The following guidelines suggest the basic elements in completing a GreenGrid® installation.

Initial Preparation

- Perform module installation only after appropriate waterproofing system, with the proper taper to allow for drainage, has been installed and inspected. If possible, it is strongly recommended that these areas be leak tested prior to module installation to confirm water-tightness.
- Erect safety signage and provide fall protection/fall prevention equipment as required under OSHA.
- Restrict traffic from work areas until modules are installed and thereafter to restrict damage to the plant material.
- Thoroughly sweep away all debris, foreign material, etc. from the waterproofing surface. Maintain general housekeeping throughout installation
- Follow manufacturers' recommendation on proper materials for protection of waterproofing surface where the GreenGrid® Modules are to be placed.

Crew Preparation and Review of Installation

- Review with each Crew member their basic job tasks/responsibilities
- Review with Crew:
 - The staging area
 - Membrane protection
 - Installation starting and completion points
 - Daily ongoing housekeeping
 - Procedures if membrane is damaged
 - Procedures to address spilled modules
- Ground and Rooftop Staging
 - Consult with the General Contractor or Building Owner for a proper area for staging modules and lifting equipment on the ground
 - Staging area shall be large enough to stage at least one truckload of materials, returnable shipping materials, and enough room for maneuvering and hoisting of materials
- Slipsheet Installation
 - Slip sheet/protection mat shall be laid on the waterproofing surface prior to installing modules. Refer to the Waterproofing System manufactures' recommendation for acceptable slip-sheet materials

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- The slip-sheet shall be loose laid over the acceptable substrate, trimming around roof penetrations and removing excess material
- Overlap adjacent slip-sheet approximately 3”.
- GreenGrid Module Installation
 - Perform module installation only after appropriate waterproofing system, with the proper taper to allow for drainage, has been installed. If possible, it is recommended that these areas be leak tested prior to module installation to confirm water-tightness.
 - All materials will be delivered on a standard 53’ tractor trailer unless otherwise specified by the contractor. It is not the responsibility of Weston Solutions to unload the materials but that of the contractor.
 - To ensure multiple deliveries (if applicable) in one day, it is best to quickly and safely unload materials near the hoisting zone to allow ample time for the delivery truck to return to the nursery to get loaded with the second delivery.
 - Vegetated modules will be assembled on shipping containers and are generally wrapped in shrink-wrap. If staged for an extended time in wrapped condition, the plants will begin to suffer in the heat of the day, thus pallets/cages shall not be stockpiled.
 - Installation of the day’s delivery of GreenGrid modules shall occur within a maximum 24-hour period from the time the modules are delivered.
 - Hoisting modules, materials and supplies
 1. Modules are to be hoisted with proper equipment that is designed to carry the load. Each cage/pallet may weigh up to approximately 2,400 pounds.
 2. Proper protection of the waterproofing surface and recognition of loading limits in the hoisting area should be considered.
 - Prior to installing the modules you should become familiar with the design plan. Compare the design and the roof surface and locate any roof penetrations that have not been previously identified. Then identify an area to begin the installation. Usually working from one direction or starting in the center and working your way out. Careful selection of a starting point is key to an efficient installation; as double, triple handling of modules will only cost you time and money.
 - Remove all debris from the substrate/slip-sheet surface that might interfere with installation of the modules or compromising the integrity of the waterproofing surface.
 - Place modules over the substrate/slip-sheet in the desired locations in accordance with the landscape design.
 - Caution must be used when working and installing the GreenGrid® System atop the waterproofing surface. The modules should be carefully lifted (not dragged) and then placed into place. Additionally, handle planted modules with care; do not drop, kick, or point-load modules during handling and installation. Roofing dollies/carts with pneumatic tires should be used to transport modules
 - Modules shall be installed in straight rows, tight against each other, and arranged in the proper directional orientation according to the design. Modules are fitted with universal alignment notches on all four sides to aid with this. Ensure modules are fitted tight against one another with no gap.

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- As you continue with the installation of the system, start watering the modules with a fine spray (by hand or sprinklers) so as to thoroughly moisten the growth media from top to bottom. Water shall be free of substances harmful to plant growth. Hoses or other methods of temporary irrigation shall be furnished by the Contractor.
- Restrict traffic from work areas until modules are installed and thereafter to restrict damage to vegetation.
- Install optional items (e.g., edge treatment, pavers, irrigation, etc.)

Trouble-Shooting

Addressing roof penetrations

Penetrations less than 6" diameter – Vent Pipes, Tie-backs, or others

- Try and center the module layout so that the penetration falls more so in the center of the module rather than along the perimeter or corners, necessitating cutting of additional modules.
- Measure and cut a hole in the bottom of the module large enough to slide freely over the penetration down to the roof membrane. Use a reciprocating saw, hand saw, snips or other tools to cut units. Also if the penetration has a waterproofing collar or flashing, make sure there is enough clearance between the cutout and this material.
- Line the bottom of the modules with filter fabric and run the fabric up the penetration 2 inches above the finished growth media level. Zip-tie or use fasteners to hold the fabric to the penetration
- Back fill the module with growth media and level off
- Re-plant vegetation and water thoroughly

Roof Drains or Penetration greater than 6" diameter

GreenGrid modules are not recommended to be placed in these areas. For these areas, it is best to just box around these penetrations. This will allow maintenance personnel area to stage tools, sit, etc when servicing or cleaning these areas.

Cutting Modules for Perimeters and Curved Areas

GreenGrid® Modules can be cut to size and shape necessary to fit odd dimensions, angles, or arching spaces. When a design indicates customization of modules, Weston will include a few additional empty modules as part of the package. We'll pre-grow the overall square footage needed, but will use the empty modules to make the odd dimensions, angles, or arching spaces.

- Measure and cut the modules to fit the space needed to complete the design.
- Place the cut side of the module on the outward side of the modular array and enclose the cut module array with the GreenGrid bendable edge treatment.
- From the pre-vegetated modules, transplant the vegetation and growth media into the customized modules to complete the installation.

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Based on project specific variables, some or all modules may need to be zip-tied together

For connecting modules together, drill a hole through the middle of the outer lip approximately 1-inch below the top edge continuing through the wall of the adjacent tray. This may require some minor brushing away of growth media/vegetation to access the drilling point. Use a 150 lb strength black “zip tie” or stainless steel tie and put the tie through the hole and cinch up tight. If using HDPE plastic zip ties ensure use of outdoor rated, UV protected zip ties. The hole/zip tie shall be at 2 foot centers:

- 2 x 2 modules - 4 ties per module

Re-planting vegetation that may be dislodged during transport or installation

- Salvage the individual plants from the spilled unit and set aside
- Place empty module on the roofing surface
- Re-place the filter fabric in the bottom of the tray and re-fill the module with the spilled growth media
- Re-lay the plants out in the module to mimic the pattern of those already installed making sure that they are spaced them evenly throughout. With your hand or a hand trowel, scoop out an area of growth media approximately 3 inches in diameter. Place the plant in the hole and gently back fill the growth media around it. Repeat until the entire module is planted and water thoroughly.

Areas to avoid placing modules

- Under storm drains, drip-lines from adjacent roofs, underneath overhangs, etc.
- Under or in line with exhaust vents
- Unprotected edges, corners of buildings, etc

Good Practices

- Remove Excess Slip Sheet Protruding from Beneath Modules. Utilize shears or similar for cutting slip sheet (Note: Exercise extreme caution so as to avoid damaging the roof membrane)
- Ensure no filter fabric has been dislodged and is visible beyond growth media level
- Replant dislodged plants
- Upon completion of the green roof installation, sweep and clean green roof related debris from roof. Especially near roof drains

Inspection

Upon completion of the installation, a warranty inspection shall be conducted by a GreenGrid Technical Representative or delegate

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30-Day Maintenance (Contractor/Installer required to complete)

- Water the GreenGrid® System once a week (weather dependent) too aid in plant establishment. System shall be watered more frequently during extended hot and dry weather especially when plants are showing signs of wilting.
- Perform spot weeding as necessary.
- Repair, rework, and replant all areas that have washed out or are eroded. Replace undesirable or dead areas with new plants.
- Upon completion of the 30-day maintenance period, a written maintenance plan for the specific green roof system shall be submitted to the building owner. A GreenGrid Representative or delegate will be made available to go over this document.