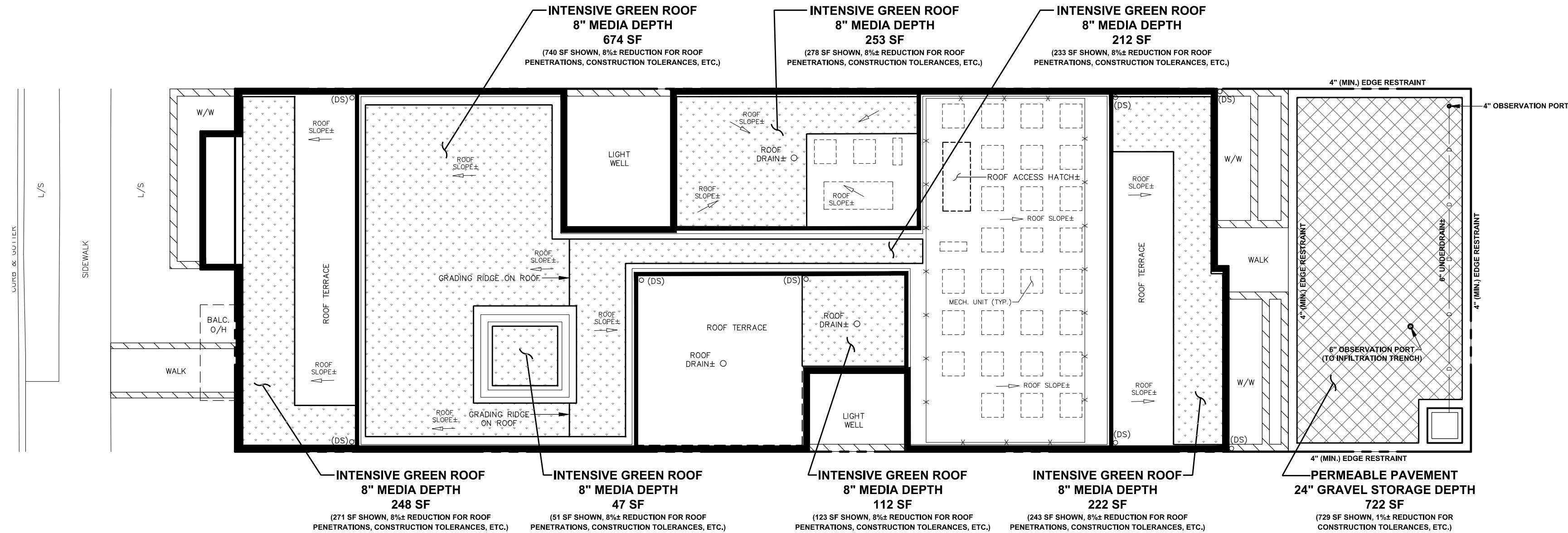


GREEN AREA RATIO (GAR) PLAN LAYOUT

SCALE: 1"=10'



GREEN ROOF ACCESS NARRATIVE:
MAIN ROOF / PENTHOUSE LEVEL: DOORS AT PENTHOUSE LEVEL, VIA ROOFTOP TERRACES
PENTHOUSE ROOF LEVEL: VIA AFFIXED LADDER ON NORTH SIDE OF BUILDING AT PENTHOUSE ROOF LEVEL

ACCESS SHALL BE PROVIDED TO ALL GREEN ROOF AREAS AS SPECIFIED IN THE CONDOMINIUM/LEASING DOCUMENTS, AND/OR VIA TEMPORARY LADDERS ALONG THE VERTICAL SIDES OF THE STRUCTURE.

ROOFTOP MATERIALS TO BE TRANSPORTED TO THE ROOF VIA A TOWER (OR SIMILAR) CRANE.

ALL ROOF SLOPES ARE 1/4" PER 1', SEE ARCHITECTURAL PLANS FOR ADDITIONAL INFORMATION.

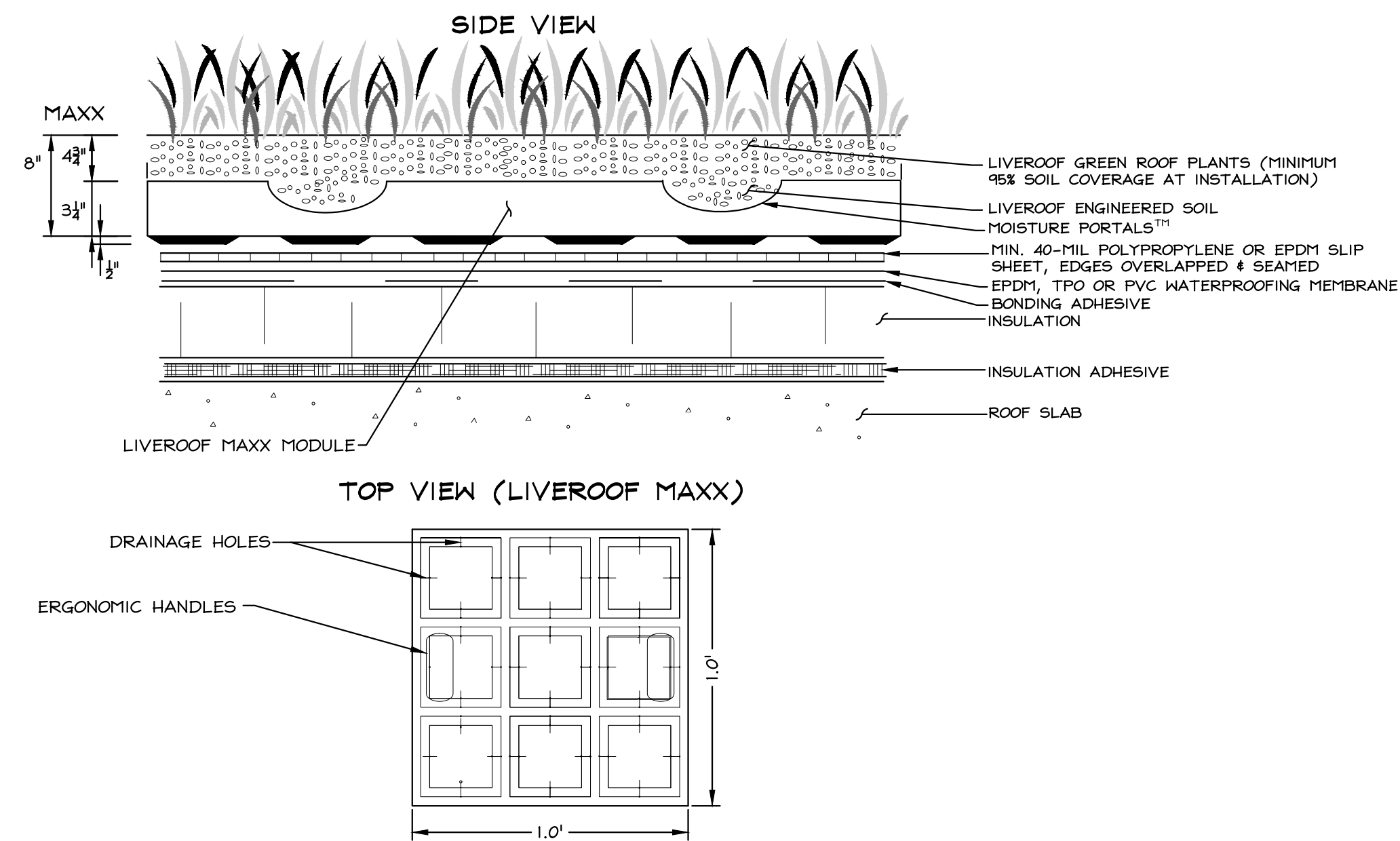
THE PROPERTY OWNER IS REQUIRED TO MAINTAIN THE LOT'S MINIMUM GAR SCORE THROUGH APPROPRIATE STEWARDSHIP AND MAINTENANCE OF LANDSCAPE ELEMENTS AFTER THE PROPERTY IS GRANTED ITS CERTIFICATE OF OCCUPANCY.

SITE HARDSCAPE FINISH TO BE GREEN ROOF, PERMEABLE PAVEMENT, OR CONCRETE WITHOUT COLOR OR STAIN.

GREEN AREA RATIO (GAR) SCORE SHEET

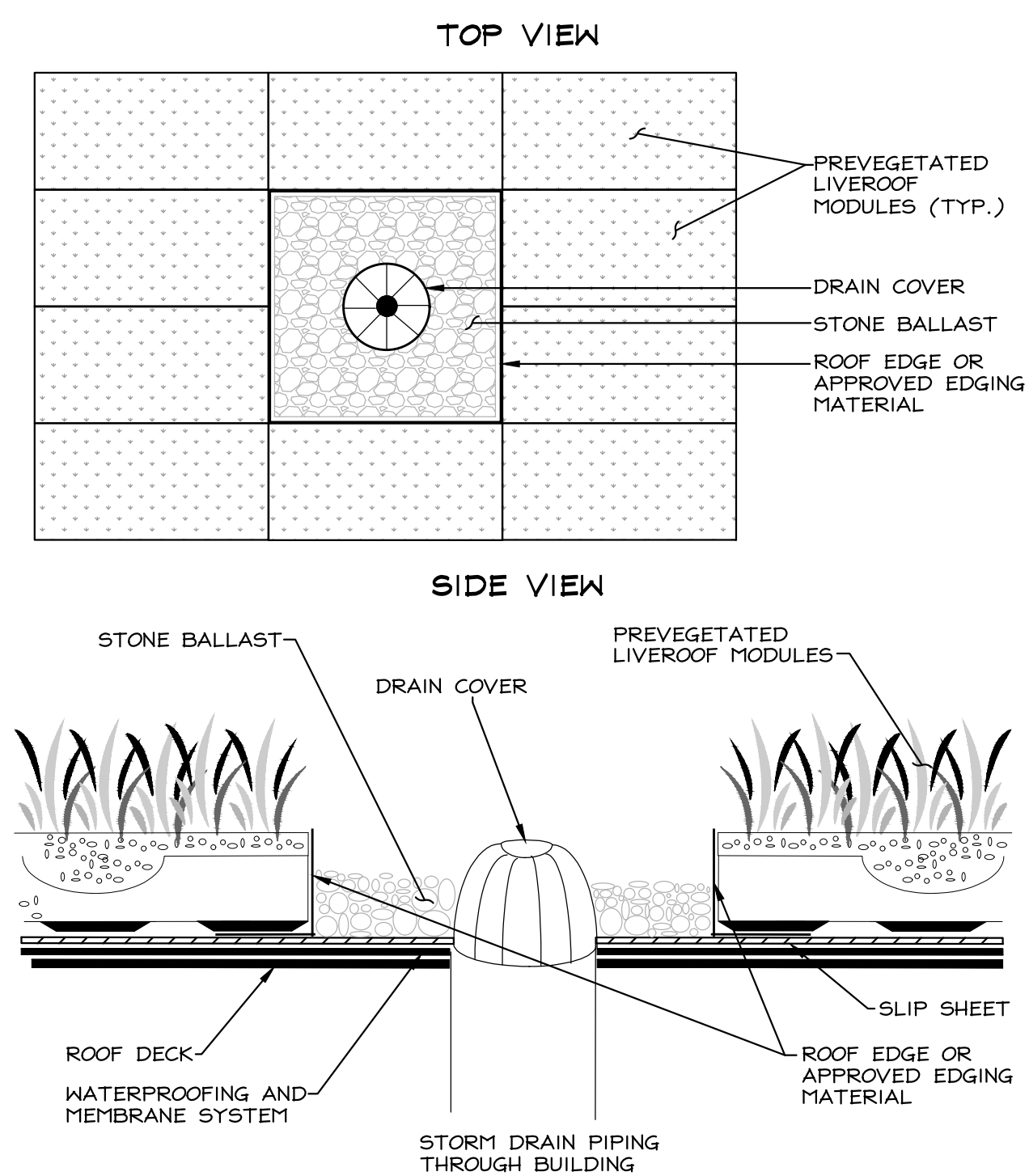
Green Area Ratio Scoresheet					
Address	Square	Lot	Zone District		
815-817 Kennedy Street, NW	2993	0064	MU-4		
Other	Lot area (sf)	Minimum Score	Multiplier	GAR Score	
	5,917	0.30		SCORE: 0.300	
Lot size (enter this value first) *					
Landscape Elements		Square Feet	Factor	Total	
A Landscaped areas (select one of the following for each area)					
1	Landscaped areas with a soil depth < 24"	square feet	0.30	-	
2	Landscaped areas with a soil depth ≥ 24"	square feet	0.60	-	
3	Bioretention facilities	square feet	0.40	-	
B Plantings (credit for plants in landscaped areas from Section A)					
1	Groundcovers, or other plants < 2' height	square feet	0.20	square feet	-
2	Plants ≥ 2' height at maturity - calculated at 9-sf per plant	# of plants	0.30	# of plants	-
3	New trees with less than 40-foot canopy spread - calculated at 50 sq ft per tree	# of trees	0.50	# of trees	-
4	New trees with 40-foot or greater canopy spread - calculated at 250 sq ft per tree	# of trees	0.60	# of trees	-
5	Preservation of existing tree 6" to 12" DBH - calculated at 250 sq ft per tree	# of trees	0.70	# of trees	-
6	Preservation of existing tree 12" to 18" DBH - calculated at 600 sq ft per tree	# of trees	0.70	# of trees	-
7	Preservation of existing trees 18" to 24" DBH - calculated at 1300 sq ft per tree	# of trees	0.70	# of trees	-
8	Preservation of existing trees 24" DBH or greater - calculated at 2000 sq ft per tree	# of trees	0.80	# of trees	-
9	Vegetated wall, plantings on a vertical surface	square feet	0.60	square feet	-
C Vegetated or "green" roofs					
1	Over at least 2" and less than 8" of growth medium	square feet	0.60	square feet	-
2	Over at least 8" of growth medium	square feet	0.80	square feet	1,414.4
D Permeable Paving***					
1	Permeable paving over 6" to 24" of soil or gravel	square feet	0.40	-	
2	Permeable paving over at least 24" of soil or gravel	square feet	0.50	361.0	
E Other					
1	Enhanced tree growth systems***	square feet	0.40	-	
2	Renewable energy generation	square feet	0.50	-	
3	Approved water features	square feet	0.20	-	
F Bonuses		sub-total of sq ft = 2,490			
1	Native plant species	square feet	0.10	-	
2	Landscaping in food cultivation	square feet	0.10	-	
3	Harvested stormwater irrigation	square feet	0.10	-	
Green Area Ratio numerator =				1,775	
*** Permeable paving and structural soil together may not qualify for more than one third of the Green Area Ratio score					
Total square footage of all permeable paving and enhanced tree growth					
361					

DETAIL - LIVEROOF MAXX SYSTEM

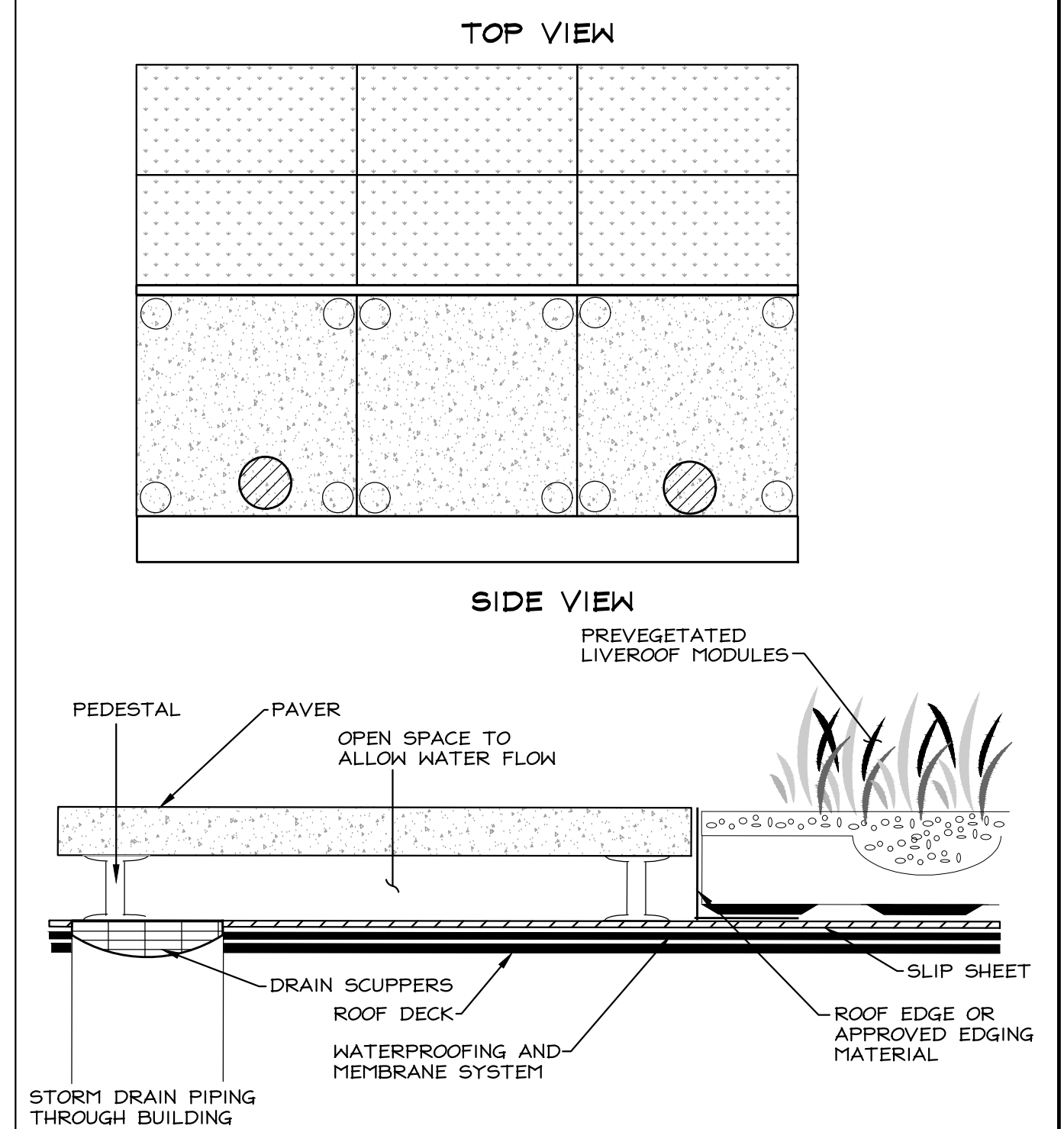


DETAIL - LIVEROOF DRAIN OPTIONS

DRAIN APPLICATION USING ROOF EDGING AND STONE BALLAST



DRAIN APPLICATION USING ROOF EDGING AND PEDESTALS



GREEN ROOF FACILITIES WILL NOT BE PERMANENTLY OR ROUTINELY IRRIGATED AFTER ESTABLISHMENT.

SPECIFICATIONS AND NOTES PROVIDED FOR REFERENCE ONLY. REFER TO LIVEROOF, LLC OR APPROVED EQUIVALENT FOR INSTALLATION INSTRUCTIONS AND APPLICATION SPECIFIC DETAILS.

REFERENCE SHEET CIV503 FOR GREEN ROOF PLANTING INFORMATION.

SEE SHEETS CIV502 + CIV503 FOR ADDITIONAL GREEN ROOF RELATED NOTES AND DETAILS.

TRAY GREEN ROOF SYSTEM (8" SOIL DEPTH - MAXX MODULE) BY LIVEROOF, LLC OR APPROVED EQUIVALENT. SEE COMPUTATIONS THIS SHEET.

PRODUCT BY: LIVEROOF, LLC
P.O. BOX 533, SPRING LAKE, MI 49456
(800) 875-1392 PHONE
CONTACT: PETER ENSIGN, LEED AP BD+C, GRP
1295 MT. ELBERT ROAD NW, RINER, VA 24149
(202) 489-8734 CELL
peter@riverbendnursery.com
www.liveroof.com



GREEN ROOF NOTES

INSTALLATION PROCEDURES

The following Standardized Procedures represent the steps that you should follow when installing the LiveRoof®system.

STEP A: ADVANCE PREPARATION

Always prepare for your LiveRoof®installation long before the LiveRoof®modules ever get to the job site. This will save you time and money, and ensure maximum quality.

Be committed to timely communication. Stay in touch with your LiveRoof®grower and the contractor or owner who hired you to do the installation.

Determine how many modules you will install each day and schedule delivery with your LiveRoof®grower 2 to 3 weeks in advance so the grower can make arrangements for trucks and drivers.

Know in advance who will install the protective slip sheet/root barrier and plan to follow the architect's specifications. Next ensure that the protective slip sheet/root barrier is pre-approved by the manufacturer of the waterproofing system. Normally the slip sheet will be 40 mi. thick or thicker.

- TPO, PVC, Polyethylene or Polypropylene, with seams overlapped and fastened by heat weld
- EPDM, with seams overlapped a minimum of 3 inches and glued with adhesive of the type that is impervious to water and unaffected by moisture, or it may also be:
- Low profile polypropylene drain board overlapped 3–6 inches and glued with manufacturer–recommended adhesive.

NEVER USE A FUZZY MOISTURE HOLDING FABRIC, SUCH AS NEEDLE PUNCHED POLYETHYLENE OR FELT as a slip sheet/root barrier. This type of fabric stays wet and encourages root growth that could impede drainage. It is also impossible to sweep and keep clean during the installation process. If you become aware that a moisture holding fabric, such as needle punched polyethylene or felt, has been installed by another contractor, stop the process immediately, and have them replace it with the proper material.

STEP B: JOB SITE PREPARATION

BEFORE INSTALLATION

1. Visit the job site with a representative from the roofing contractor to get approval for beginning the LiveRoof®installation.
2. At this point, the roof should have been tested, either by flooding or other means, to ensure that it is waterproof. This should come to you with an official written sign-off from the installer of the waterproofing system or general contractor.
3. The protective slip sheet/root barrier (if only) may also be in place and held down with temporary ballast (weight) at this time. Alternatively, you may be responsible to place the protective slip sheet/root barrier. If that is the case, its placement will be done in the near future.

STEP C: PREPARATION FOR PERSONAL SAFETY AND PROPERTY SECURITY

Conduct a preinstallation training session with your staff and attend to the following:

1. Give everyone on the installation team a copy of this booklet, LiveRoof®Standardized Procedures and review the installation process.
2. Review all OSHA and related safety procedures. Be diligent with safety harnesses and other special safety equipment for working on rooftops. In many cases you will be working off the edges of the roof.
3. Review proper body mechanics and posture for lifting modules. Bend your legs, not your back.
4. Review the importance of protecting the roof from scratches and punctures. Always report scratches or punctures to the roofing contractor. Never cover up any damage or defect.
5. Plan to protect the parapet from bumping and abrasion.
6. If it is your responsibility, properly install the protective slipsheet/root barrier. Ensure that this is preapproved by the manufacturer of the waterproofing system and held down with temporary ballast (weight).
7. Plan for protective sheets of plywood or closed cell foam to further protect the roof surface during installation.
8. Understand that when using lifting equipment, lifting capability decreases as the boom is extended. Use equipment that is big enough to easily do the job safely.
9. Edging is lightweight, plan to hold it in place with temporary ballast as a safety procedure to keep it from blowing off the roof. If the design calls for the edging to be affixed to the slip sheet, it may be done so with a manufacturer–approved adhesive. Edging should never be mechanically attached to the roof surface. One should never penetrate roofing membranes.
10. Never set the Hoppi®directly on the rooftop; instead cushion it with tires or closed cell foam and exert only enough pressure to keep it from twisting.
 - A Hoppi®loaded with 18 standard modules may weigh 1100 pounds. If loaded with 36 modules, it will weigh 2200 pounds, etc. Regardless of what device is used for conveyance, account for its weight as well as the modules.
11. Throughout the installation, constantly sweep up debris and loose growing medium, as it occurs. Do not install modules on top of gravel, debris, etc., as this will damage the modules.
12. When plants arrive shrink–wrapped, they will bake in the sun very quickly. Always, get them to the roof right away, unwrap, unload and install them.
13. Avoid walking on plants during installation.
14. Conveyors can be set on transportable jack–stands. But, these stands must have rubber bases or be set upon plywood to protect the roof membranes, please no sharp edges on roof.
15. Remember that even a flat roof will have enough slope to shed water. If carts are used on the roof, be sure that even when fully loaded they can be easily wheeled about, stopped and broken. Apply brakes or chock the wheels as needed to hold carts in place.

Note: Never work in freezing temperatures and never install frozen LiveRoof®modules as frozen soil will prevent the modules from fitting tightly together.

Important: If ever the slightest damage occurs to the underlying roof membrane, stop the process and report it to the roofing contractor for immediate repair. NEVER COVER OVER DAMAGE OR DEFECT. Roof leaks can never be tolerated.

STEP D: SET UP FOR EFFICIENT INSTALLATION

- Plan to Work Smart. Not hard.
1. Decide upon safe and efficient placement of truck and crane.
 2. Decide upon efficient rooftop unloading point and placement of conveyors.
 3. Establish a point of delivery to roller conveyors and run the roller conveyors parallel to the line of installation. Roller conveyors can be set on transportable jack–stands (with rubber feet) or tires. Conveyors should be set parallel to the line of installation and within 8 to 10 feet of the line of installation. Then, 7 or 8 rows of modules can be set before the conveyor needs to be moved back another 8 to 10 feet.
 - A well–designed installation will require almost no walking! If you are walking, you are wasting time and driving up your costs.
 4. Designate the various roles each team member will perform and plan to switch functions every hour or so. Do not multi–task, focus on doing one job right! These roles include:
 - 1. A crane or lift truck operator and Hoppi®loader at ground level
 - 2. A Hoppi®unloader on the roof top who removes modules from the Hoppi®and places them on the conveyor
 - 3. A module transporter who gently moves modules along conveyor
 - 4. A conveyor unloader on the roof top sets modules on roof surface for module placer.
 - 5. A designated sweeper to keep the roof clean
 - 6. A module placer on the roof top
 - 7. A puller to remove soil elevators

Let everyone know that every time a truck is unloaded, it should be filled back up with empty delivery Hoppi®s. Otherwise, additional trips with the truck will have to be made and additional charges will be applied.

STEP E: SET UP FOR EFFICIENT INSTALLATION

1. 1–2 days before installation (if not already done by other contractor), install slipsheet/root barrier as specified, weld, tape or glue all seams, then install irrigation as specified. Use temporary ballast (tires) to hold things in place.
2. Cut and prepare all edging and install pavers that are part of the plan.
3. If edging is left on roof, be sure to secure it with temporary ballast.
4. Set up conveyors parallel to the line of installation as previously determined.
5. YOU WILL USUALLY INSTALL MODULES FROM RIGHT TO LEFT, because of the orientation of the overlapping lip. If you fail to do this, you will not be able to install the modules correctly.
 - A. IT IS ALMOST ALWAYS BEST TO START IN A RIGHT HAND CORNER OF THE ROOF, so that the overlapping edges align correctly.
 - B. If you have to place modules across long expanses without a hard edge to push against, you may use chalk lines to ensure straight rows.
6. Lift Hoppi®over the parapet and rest lightly upon tires to keep from twisting. Do not rest full weight of Hoppi®on roof. Another method of transport is to use a crane or forklift to place or suspend the Hoppi®s in the vicinity of where the modules will be installed.
7. Hoppi®unloader removes modules and places them on conveyor. Stickers all facing module placer.
8. Notice: When removing LiveRoof®modules from the conveyance device, do not pull on, push against, or otherwise disturb, jar or dislodge the flexible soil elevators. When handling the LiveRoof®modules, do so by using the hand grips.
9. Module transporter pushes modules down conveyor line, in a smooth manner so they don't bang together and displace soil.
10. The sweeper must clean the surface before the module placer sets down each module. Avoid setting modules on soil or debris.

IMPORTANT: Avoid walking on any spilled aggregate or setting modules on top of aggregate. This can damage roofing membranes. During the entire installation the designated sweeper must sweep the roof surface clean and away from the previously placed modules, before placing each new module. Sweep with a corn or kitchen–type broom. Do not use a blower as it will blow gravel under the modules and membranes.

SAFETY: Use proper body mechanics and posture when lifting or setting down LiveRoof®modules. Bend with your knees, not your back and keep the module close to your body.

LiveRoof®modules have a front and back side. The front side (the side away from you as you are placing the modules) and the right side have overlapping edges that center the containers and make them align correctly. The orange sticker should face the installer during placement.

9. Conveyor Unloader removes module from conveyor and sets on roof near module placer with sticker facing out.
10. Once the surface is swept clean the module placer sets down the first module and tightly pushes it in against the edging or parapet with the overlapping lip facing away from him.

IMPORTANT: The sticker must face the Module Placer!

The overlapping lip faces away from the Module Placer!

IMPORTANT: LiveRoof®modules have a front and back.

The overlapping lip is oriented away from the placer.

The short right side also has an overlapping lip.

11. Set the second module next to it.
 - Make sure its overlapping lip overlaps the half–moon shaped "moisture portal" of the first module.
 - Line them up precisely!
 - Flip any overhanging plant material up and out of the way.
 - Lift and place module snugly in place.
 - Continue to repeat this process until the first row is installed.

Or, once the first row has 5 to 10 modules placed, another placer may begin the process with the second row.

12. REMOVAL OF SOIL ELEVATORS: As the second row is set, the flexible "soil elevators" from the modules in the first row will be 100% surrounded by either modules or edging. AT THIS POINT THEY SHOULD BE PULLED OUT BY THE PULLER.

A good puller can pull 2 adjacent soil elevators out at the same time.

- Soil elevators must be pulled in a sideways fashion not upward (which displaces soil).
- You may want to use a pair of spring loaded pliers.
- Always pull as you go. Don't wait or you will end up trampling the plants and you will overlook many of the soil elevators.
- The puller should bag the soil elevators as they removes them. They should be recycled.

13. The above processes are repeated over and over until all modules are placed.

CUSTOM CUTTING MODULES TO FIT ODD-SIZED AREAS

LiveRoof®modules may be cut, with mature plants and soil in the container, with a radial arm saw with masonry blade much as one would use to cut paver stones. A portable masonry saw also works and a reciprocating saw may be used for curved cuts. Always install modules in a manner that minimizes custom cutting to make installation cost effective. Always wear protective goggles and gloves.

- Handle gently; the roots will bind the soil, but can be disturbed by rough handling.
- Use a cardboard edge or tape measure to transfer your measurements to the person doing the cutting.

IMPORTANT: If the roof is sloping and custom cutting is required, start at the bottom and work up. This way if there is any compression, the compression will be against modules that have not been cut. If the roof is flat, compression will be against modules that have not been cut. When the custom cutting is to be done on a non–draining edge, (top or side of the roof) custom cut modules may be held in place by fitting tightly against either another module or the edging.

In the event of soil infilling between module and parapet or edging, where the gap is 4 inches or less, use filter fabric and LiveRoof®brand engineered green roof soil.

STEP F: WRAP UP AND INITIAL WATERING

The job is not finished until all delivery modules are loaded back on the grower's truck. If the driver must wait or return to the job site additional charges will apply.

INITIAL WATERING

Once installed, immediately and completely water plants. Soak the soil from top to bottom; this settles the soil and requires about 1 1/4 gallons of water per module.

SITE CLEANUP
Clean the job site daily and at the end of the job, clean up the job site 100%, leaving no waste or debris.

FINAL SIGN OFF AND MAINTENANCE PROTOCOL
Arrange for final sign–off on the installation. (refer to certified installer training manual.)

Give the owner a copy of the LiveRoof®Maintenance Protocol.

MAINTENANCE PROTOCOL

The LiveRoof® Maintenance Protocol is simple and takes you through the year season by season. It is based upon sound horticulture and lean processes, and is designed to protect your investment with minimal investment of time.

DOCUMENTATION

Always record each maintenance event. By keeping records (in spreadsheet format), you will learn the particular nuances of caring for your LiveRoof®.

SPRING MAINTENANCE

Spring Maintenance begins with an ANNUAL SOIL TEST 2–3 weeks before the spring "growth flush."

The spring "growth flush" varies with locale. It is the time when plants "wake up" and grow very fast. This typically coincides with "spring rains" such as Forsythia, Crocuses, and Wisteria. In Tennessee, for example, it occurs around mid March, while in Minnesota it begins around mid April.

EARLY TO MID MARCH

PERFORM ANNUAL SOIL TEST – To Check Fertility and pH LiveRoof® soils are formulated for sustainable nutrient content, but heavy rainstorms and snowmelt can leach nutrients and deplete fertility. Soil testing is best conducted during late winter, which leaves time to apply fertilizer, if needed, before the spring growth flush, the time when plants must require adequate nutrition.

TO TEST SOIL, gather a two cup sample by digging soil out in small quantities (using a large spoon) from at least 15–20 separate places throughout the roof. Place these small samples ("sub–samples") in a labeled, sealed, plastic bag, or feed kit from your desired testing lab. Contact LiveRoof®, LLC for recommended laboratories and test procedures.

MARCH

BEGIN BIWEEKLY "WEED WALK" AND CONTINUE UNTIL LATE FALL – Weeds are opportunists, and some weeds actually grow during winter. Therefore, you will probably have a few weeds waiting for you in spring. Once your roof is thawed out it is time to walk your roof and pull any and all weeds, no matter how small–every two weeks. Doing this is efficient, and the reason for the two week interval is that by pulling weeds when they are tiny, you keep them from maturing and creating seed, which in turn just creates more weeds.

If you need every two weeks, you Weed Smart, not hard, and actually minimize the time needed for weeding. In fact, you can maintain an acre sized LiveRoof® in just 20 minutes every two weeks, using this method. That's a total of only 8 hours per year in areas of temperate climate! On the other hand, if you neglect your bi–weekly weed walk, weeds can become plentiful and time consuming to remove.

EARLY APRIL

APPLY FERTILIZER (IF NEEDED) – Upon receipt of your soil test results from the lab, interpret the information and determine the need, if any, for fertilization. Pay attention to the various nutrient levels, such as Nitrogen (N or NO3–N), Potassium (K), Phosphorus (P). For each of these, the soil report will indicate if there is a Low (L), Moderate (M), or High (H) amount of that nutrient in the soil. The most important of these, is Nitrogen. If Nitrogen is in the soil, your soil contains less than a Moderate (M) amount of nitrogen, the plants may thin out and create areas of exposed soil. Therefore, if the Nitrogen level is Low, it may be advisable to apply supplemental fertilizer.

- When applying fertilizer to green roofs, it is important to be sensitive of runoff potential. Ask yourself, where is the runoff water going, and what might it affect (e.g., fish, frogs, etc.)? In all cases, it is imperative to use a "Slow Release fertilizer rather than a conventional fertilizer to minimize nutrient runoff. Slow release fertilizers are coated with a waxy or resinous covering that allows the fertilizer to release into the soil over time, rather than all at once. Such fertilizers are more readily absorbed by the plants, and therefore are less likely to contaminate runoff water.

- Always choose a high quality slow release granular fertilizer–available at your local garden center. Good brands are Compostrol®and Nutricote®, but there are others. High quality fertilizers are designated "Coated Slow Release Fertilizer", and the label will typically indicate something to the effect of provides 4 to 6 months of continuous feeding". Some high quality "turf–grade" fertilizers may work well on the green roof, but they too must indicate "Slow release", and must contain NO Herbicides or other Pesticides.
- Fertilization is best conducted during the spring, with a single annual application... Spring is the correct time because the plants are actively growing and not under drought stress.

All fertilizers will be labeled with three numbers, which indicate the % by weight of Nitrogen (N), Phosphorus (P), and Potassium (K), in the fertilizer. Common formulations are 18–6–12 or 14–14–14, but there are many others. In some communities, Phosphorus–containing fertilizers are prohibited due to the potential for creating algae growth in waterways. If in doubt, check with your local cooperative extension agency (caresusa.gov/Extension/).

- A Rotary Spreader (push type or belly–crank type) can be used to ensure that fertilizer is applied evenly.

In all cases, fertilizer should be applied in accord with manufacturer's recommendations, and evaluated by the applicator for runoff potential in accord with site specifics. The greater the runoff potential, the lower should be the application rate. Applicator assumes all risks associated with fertilizer application.

pH: Another important part of your soil analysis is the pH. pH is an indication of the acidity or alkalinity of the soil. Plants have a preferred pH range for optimal utilization of nutrients, and in the case of most green roof plants, this range is 6.0 to 8.0. Below 6.0 is too acid, and above 8.0 is too alkaline. If your soil pH is below 6.0, consult your soil testing lab for recommendations to increase alkalinity. Typically, this means adding lime. And, if the soil is above 8.0, it can be made more acid with elemental sulphur or an application of acidifying fertilizer. Since LiveRoof® soils are formulated to buffer against pH changes, the need to adjust pH is relatively uncommon.

MOWING (IF DESIRED)

Mowing is sometimes conducted in order to tidy up the roof after winter. Persistent dried seed heads can detract from the aesthetic qualities of the green roof. And, in some cases they are so thick as to shade the foliage. If this occurs, you may choose to mow the green roof and the time to do this is early April (adjust accordingly to precede spring growth flush).

If you choose to mow your green roof, set the mower blade just above the foliage. The idea is to mow the dried seed heads, but avoid cutting the foliage. Do not bag the clippings, instead blow them into the vegetated portion of the roof so that they can decompose and nourish the soil.

When mowing, BE SAFE. Use protective equipment, including harnesses if needed, and make sure that the roof is free of frost or other slipping hazards.

APRIL TO JUNE

CONTINUE YOUR BIWEEKLY "WEED WALK"

This will only take a few minutes. In fact, it's like a walk through a meadow, and it's easy. Simply pull any and all weeds before they have a chance to flower and set seed. You might not till up your hand with tiny weeds, but this is what prevents the development of a "weed bank" within your green roof. And, it is what keeps your total maintenance time to a minimum.

Note: It is especially important that no woody plant ever be allowed to establish in a green roof system. Woody plants have extensive root systems that can damage roofing membranes.

Other things to check for when taking your Weed Walk.

- DISPLACED SOIL: Nesting birds can displace soil. Any displaced soil should immediately be replaced.
- DRAINAGE INSPECTION: Roof drains should be inspected every two weeks and any debris, pebbles, or leaves should be removed to keep drains flowing freely.

DEBRIS REMOVAL

With each visit, debris that has blown in should immediately be removed as it may lodge on top of the plants and impair their growth.

PEST CONTROL

Occasionally pest insects such as aphids may show up and bother the plant material, and while not commonplace, fungal problems like mildew can occur. LiveRoof®/LLC suggests that most pest problems that occur on green roofs are the result of an imbalance in the relationship of the pest organism and its natural biological controls (beneficial insects like ladybugs and lacewings). Typically pests and fungal infirmities (like blight or mildew) are triggered by unusual weather events that cause the pest to multiply faster than it's biological control. In time, the biological control usually catches up and most pest and disease issues tend to be temporary in nature.

On the other hand, if you detect persistent pest problems, LiveRoof® suggests the use of organic and natural biological control agents instead of conventional pesticides. Conventional pesticides may runoff into sensitive areas and might also damage roofing membranes. Consult a professional prior to applying any biocontrol or pest or disease fighting agent.

SUMMER MAINTENANCE

JUNE TO SEPTEMBER

CONTINUE YOUR BIWEEKLY "WEED WALK"

Even during summer, your biweekly weed walk will only take a few minutes. It's easy. Just pull any and all weeds before they flower and set seed. This is the secret to optimizing your green roof and keeping your maintenance costs and time to a minimum.

IRRIGATION

In northern North America, irrigation may not be needed to keep your LiveRoof®alive during most summers provided it is the Standard 4 1/4" deep system populated with Sedums, but prolonged hot dry weather can result in plant thinning or death. In warmer climates, regular irrigation will all probably be required. Regardless of climate, LiveRoof® recommends irrigation (in a manner practical and efficient for the scale of the installation) as a "temporary" management tool during PROLONGED HOT DRY WEATHER.

PROLONGED HOT DRY WEATHER is generally defined as periods of 75 degree weather, with less than 1 inch of rainfall per month. This "balloon" time period will likely be less if the temperatures are hotter, or on sloping roofs and roofs exposed to persistent winds or reflected sunlight. Such conditions can dry out the soil and cause the plants to go dormant, or in extreme cases, to dry up and die.

- Should you have to shovel pathways on your roof during winter, avoid using salt and other deicing chemicals. They will kill the plants and damage the pavers. Instead, use sand or cat litter as an anti–slip agent.

During prolonged hot dry weather or when plants become drought stressed, irrigation should be applied, temporarily, to re-wet the soil to the point of saturation. This will keep plants from going dormant, keep them plump and healthy so they can cover the soil effectively, and optimize their appearance. It also enhances the evaporative cooling effect of the green roof.

Thoroughly irrigating, as indicated above, will pay off significantly. Not only will the plants be healthier and fuller, bringing reduced maintenance costs, but the actual cost of irrigation is minimal compared to the energy savings derived from enhancing the evaporative cooling of the green roof.

In areas of shade, less irrigation will be required.

FALL MAINTENANCE

OCTOBER TO NOVEMBER

CONTINUE YOUR BIWEEKLY "WEED WALK" – Many weeds germinate and grow during fall and you should continue your bi–weekly weed walk until it gets very cold, perhaps a few weeks before snowfall in northern climates (but stay off the roof if there is frost or ice). Some weeds are capable of reproducing during winter, even under the snow, so you will want to have the roof "weed–free" going into winter.

IN ADDITION:

- Never fertilize during fall. It may stimulate tender growth and compromise the cold hardiness of the plant material.
- Rake up any fallen and matted tree leaves. These can smother the green roof plants.
- Be sure the drains are free–flowing and not impaired by fallen leaves. Impaired drainage can damage the roof and damage or kill the plants.

WINTER MAINTENANCE

DECEMBER TO FEBRUARY

IN NORTHERN TEMPERATE REGIONS: Across the northern temperate region of North America, the plants will be dormant and the soil will usually be frozen during the winter season. This is the time to stay off the roof as it may be slippery and dangerous. There is nothing to be done during the winter except perhaps snow removal from rooftop walkways–if roof icing and egress is required.

- Should you have to shovel pathways on your roof during winter, avoid using salt and other deicing chemicals. They will kill the plants and damage the pavers. Instead, use sand or cat litter as an anti–slip agent.
- The use of heat or hot water on the roof can be applied without damage to roofing membranes.
- Also, avoid piling all the snow in one place. Instead disperse it evenly over the green roof plantings. Excess snow can potentially damage the plant material by insulating the plants and keeping them too warm, thereby triggering fungal diseases.

IN WARM CLIMATE REGIONS: In areas of warm climate, the plants will likely be dormant or semi–dormant during the winter, but the weeds will not be. Therefore, you must follow the same "Weed Walk" protocol as described under the heading Spring Maintenance.

- Precaution: Even in areas of warm climate, it is possible to have ice and frost. Avoid being on the roof when there is ice or frost.



Turf & Soil Diagnostics

Riverbend Nursery, LLC
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Date Received Jan-29-2018
Date Reported Jan-29-2018
Facility Product Development

Maximum Media Density for Dead Load Analysis of Green Roof Systems ¹

Lab ID#	Sample Name	Water Permeability (Saturated Hydraulic Conductivity) (in/hr)	Initial Media Density (g/cm ³)	Initial Media Density (lb/ft ³)	Maximum Media Density (Saturated Density) (lb/ft ³)	Maximum Media Density (Saturated Density) (lb/ft ³)	Maximum Water Retention (%)	Dry Media Density (lb/ft ³)
18110043-1	Live Roof Media	25.9	10.9	75.2	117	91.7	1.47	99.2
		0.7-11	0.3-30					45-68
Intensive Greening Sites in Multi-Course Construction***		1.4-165	0.6-79					35-65

***FL Guidelines

Lab ID#	Sample Name	Initial Sample Wt. (Kg)	Sample Volume (cm ³)	Initial Sample Height (cm)	Final Sample Height (cm)	Sample Wt. After Draining (Kg)	Total Pore Space (%)	Air-filled Porosity ¹ (%)	pH ²	Electrical Conductivity mmhos/cm	Organic Matter ³ (%)
18110043-1	Live Roof Media	2.108	0.0018	8.9	10.0	2.6	96	4	7.3	0.4	5.3
Intensive Greening Sites in Multi-Course Construction***								> 10	6.0-8.5	< 3.6	< 9
Extensive Greening in Multi-Course Construction***								> 10	6.0-8.5	< 5	< 6.5

Particle Size Evaluation*					% Passing US sieve (mm)				
Lab ID#	Sample Name	% Sand 2.0 - 0.063 mm	% Silt 0.063-0.002 mm	% Clay < 0.002mm	Gravel 3/8"	Gravel 1/8" (3/16")	V. Coarse 18 (1.0)	Medium 60 (0.25)	V. Fine 250 (0.075)
18110043-1	Live Roof Media	49.9	10.8	2.5	99.5	76.0	63.3	45.8	23.6
Intensive Greening Sites in Multi Course Construction***		0 - 20 Combined			90 - 100	50 - 100	40 - 100	28 - 100	10 - 40
		0 - 20 Combined			90 - 100	50 - 100	40 - 100	28 - 100	10 - 40

¹ ASTM E2399 "At Maximum Media Density (Water-holding Capacity)"

² ASTM D4972 w/ CaCl₂ (not screened)

³ ASTM F1632 Method B "Asheed at 550° C (FLL Guidelines)"

Samples were tested as received and comments pertain only to the samples shown.

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Sample condition upon receipt was normal.

Samples were received with a transmittal letter.

Reviewed by:

Page 2 of 2

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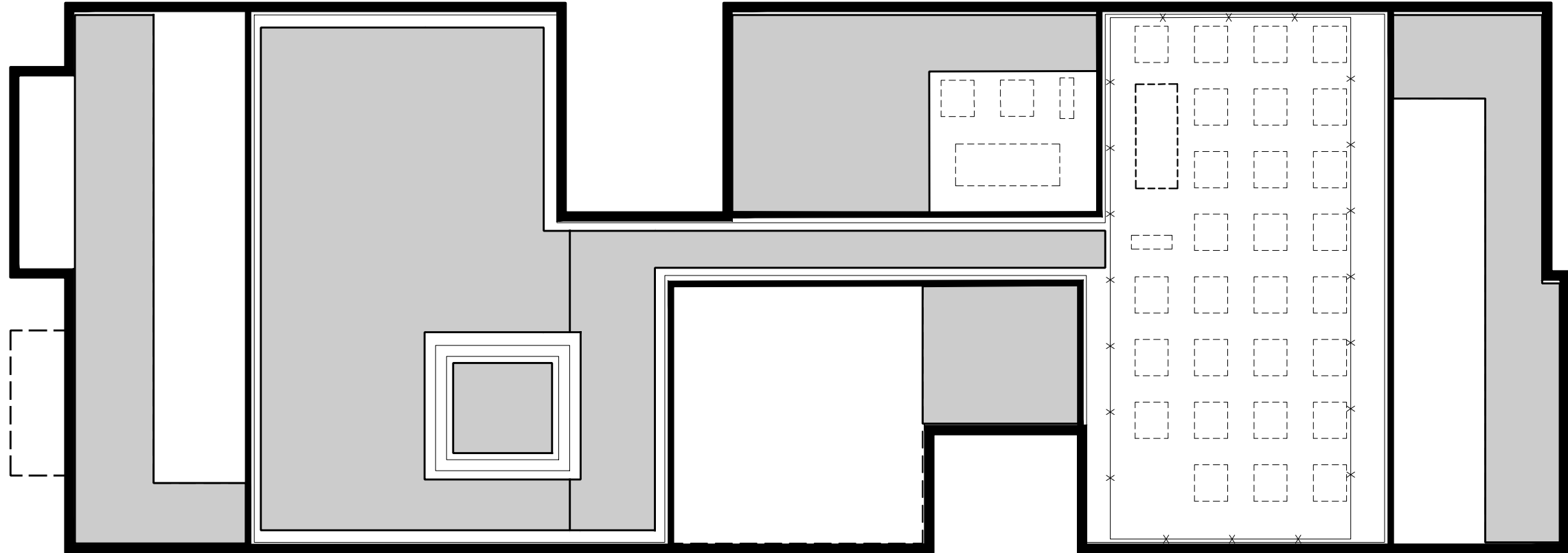


LiveRoof System Properties (Values Listed per Square Foot)

SYSTEM	LITE	STANDARD	DEEP	MAXX
Soil Media Depth	2.5" (63 MM)	4.25" (108 MM)	6" (152 MM)	8" (203 MM)
Dry Weight	+/- 12 LBS/SF	+/- 20 LBS/SF	+/- 30 LBS/SF	+/- 40 LBS/SF
Fully Saturated Weight	15.17 LBS/SF	27.29 LBS/SF	40.50 LBS/SF	60.65 LBS/SF
Drainage Layer Depth	0.5"			
Maximum Water Holding Capacity (Per ASTM E2399)	SEE TEST DATA ABOVE			
Soil Media Volume of Voids (total pore volume)				
System Total Stormwater Storage Volume	0.100 CU FT 0.74 GAL	.170 CU FT 1.26 GAL	.240 CU FT 1.79 GAL	.320 CU FT 2.38 GAL
WITH ROOFBLUE™ RISER (for use with control-flow drain system)				
Maximum Water Depth	3.5"			
Void Space	90.5%			
Maximum Water Volume Detained	263 CU FT 1.96 GAL (16.36 LBS)			
Maximum Water Volume Managed with Retention and Detention Actual water retained / detained will vary with water collection, spacing and roof pitch.	.366 CU FT 2.73 GAL	.439 CU FT 3.27 GAL	.511 CU FT 3.81 GAL	.594 CU FT 4.43 GAL
Fully Saturated Weight (combined per system and RoofBlue max. water volume detained)	32-34 LBS/SF	44-46 LBS/SF	57-67 LBS/SF	77-82 LBS/SF
WIND AND FIRE RESISTANCE				
FM Approval Standard for Vegetative Roof Systems (FM 4477)	FM Approved			
Fire Resistance (ASTM E108) with Succulent Plantings * Test Performed ** Performance Expected Based on Similar Testing	Class A**	Class A*	Class A**	
External Fire Design Standard for Vegetative Roofs (ANSI/SPRI VF-1)	Meets requirements for generic fire resistive vegetative systems (4.1)			
Wind Uplift Resistance (CAN/CSA A123.24-15) * Full Scale Test Performed ** Performance Expected Based on Similar Testing	133 PSF*		133 PSF**	
Wind Design Standard for Vegetative Roofing Systems (ANSI/SPRI RP-14)	#4 Ballast (3.13.1)	#2 Ballast (3.13.2) and #4 Ballast (3.13.1)		

GREEN ROOF PLANTING PLAN

SCALE: 1"=10'



- (19.64± LBS) SEDUM ALBUM
- (19.64± LBS) SEDUM ALBUM 'MURALE'
- (19.64± LBS) SEDUM HYBRIDIUM 'IMMERGRUNCHEN'
- (19.64± LBS) SEDUM KAMTSCHATICUM
- (19.64± LBS) SEDUM KAMTSCHATICUM 'WEIHENSTEPHANER GOLD'
- (19.64± LBS) SEDUM REFLEXUM 'BLUE SPRUCE'
- (19.64± LBS) SEDUM SEXANGULARE
- (19.64± LBS) SEDUM SPURIUM 'JOHN CREECH'
- (19.64± LBS) SEDUM STEFCO

NOTE: CUTTINGS TO BE
EQUALLY SPREAD AND
DISTRIBUTED THROUGHOUT
THE GREEN ROOF AREAS

GREEN ROOF SEDUM CUTTING PLANTING SCHEDULE

TAG(S)	COMMON NAME	BOTANICAL NAME	LOADING RATE	TOTAL LOADING
A	WHITE STONECROP	SEDUM ALBUM	0.011 LBS PER SF (1.1 LB PER 100 SF)	19.64 LBS±
B	WHITE STONECROP	SEDUM ALBUM 'MURALE'	0.011 LBS PER SF (1.1 LB PER 100 SF)	19.64 LBS±
C	'IMMERGRUNCHEN' SIBERIAN STONECROP	SEDUM HYBRIDIUM 'IMMERGRUNCHEN'	0.011 LBS PER SF (1.1 LB PER 100 SF)	19.64 LBS±
D	ORANGE STONECROP	SEDUM KAMTSCHATICUM	0.011 LBS PER SF (1.1 LB PER 100 SF)	19.64 LBS±
E	'WEIHENSTEPHANER GOLD' RUSSIAN STONECROP	SEDUM KAMTSCHATICUM 'WEIHENSTEPHANER GOLD'	0.011 LBS PER SF (1.1 LB PER 100 SF)	19.64 LBS±
F	'BLUE SPRUCE' REFLEXED STONECROP	SEDUM REFLEXUM 'BLUE SPRUCE'	0.011 LBS PER SF (1.1 LB PER 100 SF)	19.64 LBS±
G	TASTELESS STONECROP	SEDUM SEXANGULARE	0.011 LBS PER SF (1.1 LB PER 100 SF)	19.64 LBS±
H	'JOHN CREECH' CAUCASIAN STONECROP	SEDUM SPURIUM 'JOHN CREECH'	0.011 LBS PER SF (1.1 LB PER 100 SF)	19.64 LBS±
I	BLUSHING STONECROP	SEDUM STEFCO	0.011 LBS PER SF (1.1 LB PER 100 SF)	19.64 LBS±
TOTAL SEDUM LOADING (9 SPECIES SPEC'D)			0.10 LBS PER SF (10 LBS PER 100 SF)	176.8 LBS±

PLANT SELECTION SUBJECT TO FIELD MODIFICATION. ANY SUBSTITUTIONS TO BE APPROVED BY LANDSCAPE ARCHITECT OF RECORD AND REFLECTED ON GREEN AREA RATIO AS-BUILT. OPTIONAL ACCENT PLANTS MAY BE INSTALLED WITHIN INTENSIVE GREEN ROOF (8" MEDIA DEPTH OF GREATER) FACILITIES. COORDINATE ACCENT PLANT SELECTION WITH LIVEROOF AND ADHERE TO SPACING REQUIREMENTS. ACCENT PLANTS TO BE PLANTED TO THE AMOUNT SPECIFIED ON THE GAR PLAN. ADDITIONAL ACCENT PLANTS MAY BE PLANTED TO EXCEED MINIMUM REQUIREMENTS, COORDINATE WITH LANDSCAPE ARCHITECT OF RECORD AND LIVEROOF.

SEDUM PLANTING NOTES

- SELECTED SEDUMS ARE SUBJECT TO CHANGE, SEE ALTERNATE SEDUM LIST BELOW.
- A MINIMUM OF 6 SEDUM SPECIES MUST BE PROVIDED.
- A MINIMUM TOTAL SEDUM CUTTING LOADING OF 0.1 LBS PER SF (OR 10 LBS PER 100 SF) MUST BE MAINTAINED AND SHALL BE EVENLY DISTRIBUTED/WEIGHTED AMONG THE PLANTING SPECIES.
- SEDUMS CUTTINGS SHALL BE SPREAD IMMEDIATELY WHEN POSSIBLE. SEDUM CUTTINGS CAN BE STORED FOR UP TO 2 DAYS UNDER IDEAL COOL (75 DEGREES OR LOWER) CONDITIONS. IN SHADED OR INDOOR/AIR CONDITIONED AREAS, PACKAGED CUTTINGS SHALL BE MONITORED TO MAINTAIN MOISTURE CONTENT DURING STORAGE, WHEN APPLICABLE.
- CUTTINGS ARE TO BE SPREAD BY HAND ONTO THE PREPARED SURFACE OF THE GREEN ROOF GROWING MEDIA.
- HYDROMULCH WITH AN INTEGRAL TACKIFIER IS RECOMMENDED TO BE APPLIED AT THE SURFACE ABOVE THE NEWLY INSTALLED/SPREAD SEDUM CUTTINGS. WHEN NOT AVAILABLE, DRY MULCH MAY BE USED. IF DRY MULCH IS USED IT SHALL BE THOROUGHLY WETTED AFTER APPLIED.
- ALTERNATIVELY, PLUGS MAY BE PLANTING INSTEAD OF CUTTINGS. PLUGS SHALL BE PLANTED AT A MINIMUM RATE OF 2 PLUGS PER SQUARE FOOT AND EVENLY DISTRIBUTED AMONG THE PLANTING SPECIES.
- ALTERNATIVELY, PRE-GROWN TRAYS OR MATS MAY BE UTILIZED. IF UTILIZED, 80% MINIMUM COVERAGE SHALL BE PROVIDED AT THE TIME OF INSTALLATION.

SEDUM CUTTING
LOADING CALCULATIONS

TOTAL GREEN ROOF AREA: 1,768 SF
SEDUM CUTTING LOADING (TOTAL) = 10 LBS PER 100 SF

1,768 SF * (10 LBS / 100 SF) = 176.8 LBS

NUMBER OF SEDUM SPECIES = 9 SPECIES
176.8 LBS / 9 SPECIES = 19.64 LBS PER SPECIES
(TOTAL LOADING FOR SITE PER SPECIES)

ALTERNATE SEDUM PLANTING LIST

(CONSULT WITH LIVEROOF FOR AVAILABILITY OF ALTERNATE PLANTS. COORDINATE ALL SPECIES REPLACEMENTS/SWAPS WITH LANDSCAPE ARCHITECT OF RECORD)

SEDUM ACRE 'AUREUM'
SEDUM AIZON 'EUPHORBIOIDES'
SEDUM ALBUM 'ATROPURPUREUM'
SEDUM ALBUM 'CHLOROTICUM'
SEDUM ALBUM 'CORAL CARPET'
SEDUM ALBUM 'FARGO ISLAND'
SEDUM ALBUM 'HILDBRANDTII'
SEDUM ALBUM 'MURALE'
SEDUM ELLACOMBIANUM
SEDUM FLORIFERUM 'WEIHENSTEPHANER GOLD'
SEDUM FLORIFERUM 'WINTER MAHOGANY'
SEDUM HYBRIDIUM 'OZAR'S GOLD'
SEDUM HYBRIDIUM 'IMMERGRUNCHEN'
SEDUM KAMTSCHATICUM
SEDUM KAMTSCHATICUM 'KURILENSIS'
SEDUM REFLEXUM 'BLUE BLUSH'
SEDUM REFLEXUM 'BLUE DAWN'
SEDUM REFLEXUM 'GREEN GLOW'
SEDUM REFLEXUM 'MOONSHADOW'
SEDUM REFLEXUM 'SPRING GREEN'

SEDUM REFLEXUM 'SUN TOUCHED'
SEDUM REFLEXUM 'SUNSPASH'
SEDUM RUPESTRE 'ANGELINA'
SEDUM SEXANGULARE
SEDUM SPURIUM 'ALBUM SUPERBUM'
SEDUM SPURIUM 'CHEERY BLUSH'
SEDUM SPURIUM 'CHERRY BLAST'
SEDUM SPURIUM 'CHERRY SPLASH'
SEDUM SPURIUM 'DRAGON'S BLOOD'
SEDUM SPURIUM 'ELIZABETH'
SEDUM SPURIUM 'FULDAGLUT'
SEDUM SPURIUM 'GREEN MANTLE'
SEDUM SPURIUM 'GUACAMOLE'
SEDUM SPURIUM 'JOHN CREECH'
SEDUM SPURIUM 'MOONSHINE'
SEDUM SPURIUM 'NEWWOOD'
SEDUM SPURIUM 'RAINBOW'
SEDUM SPURIUM 'ROSUM'
SEDUM SPURIUM 'ROYAL PINK'
SEDUM SPURIUM 'SUMMER GLORY'
SEDUM SPURIUM 'WILD CHERRY'
SEDUM SPURIUM 'YOO DOO'
SEDUM STEFCO
SEDUM TAKESIMENSE 'GOLD CARPET'

SEE SHEETS CIV501 + CIV502
FOR ADDITIONAL GREEN ROOF
RELATED NOTES AND DETAILS.

GREEN ROOF FACILITIES WILL NOT
BE PERMANENTLY OR ROUTINELY
IRRIGATED AFTER ESTABLISHMENT.

SPECIFICATIONS AND NOTES PROVIDED FOR
REFERENCE ONLY. REFER TO LIVEROOF,
LLC OR APPROVED EQUIVALENT FOR
INSTALLATION INSTRUCTIONS AND
APPLICATION SPECIFIC DETAILS.

TRAY GREEN ROOF SYSTEM (8" SOIL
DEPTH - MAXX MODULE) BY LIVEROOF,
LLC OR APPROVED EQUIVALENT. SEE
COMPUTATIONS THIS SHEET.

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