

The LiveRoof Operation Manual is simple and takes you through each year season-by-season. It is based upon sound horticulture and lean processes, and is designed to protect owner investment with minimal time and costs.

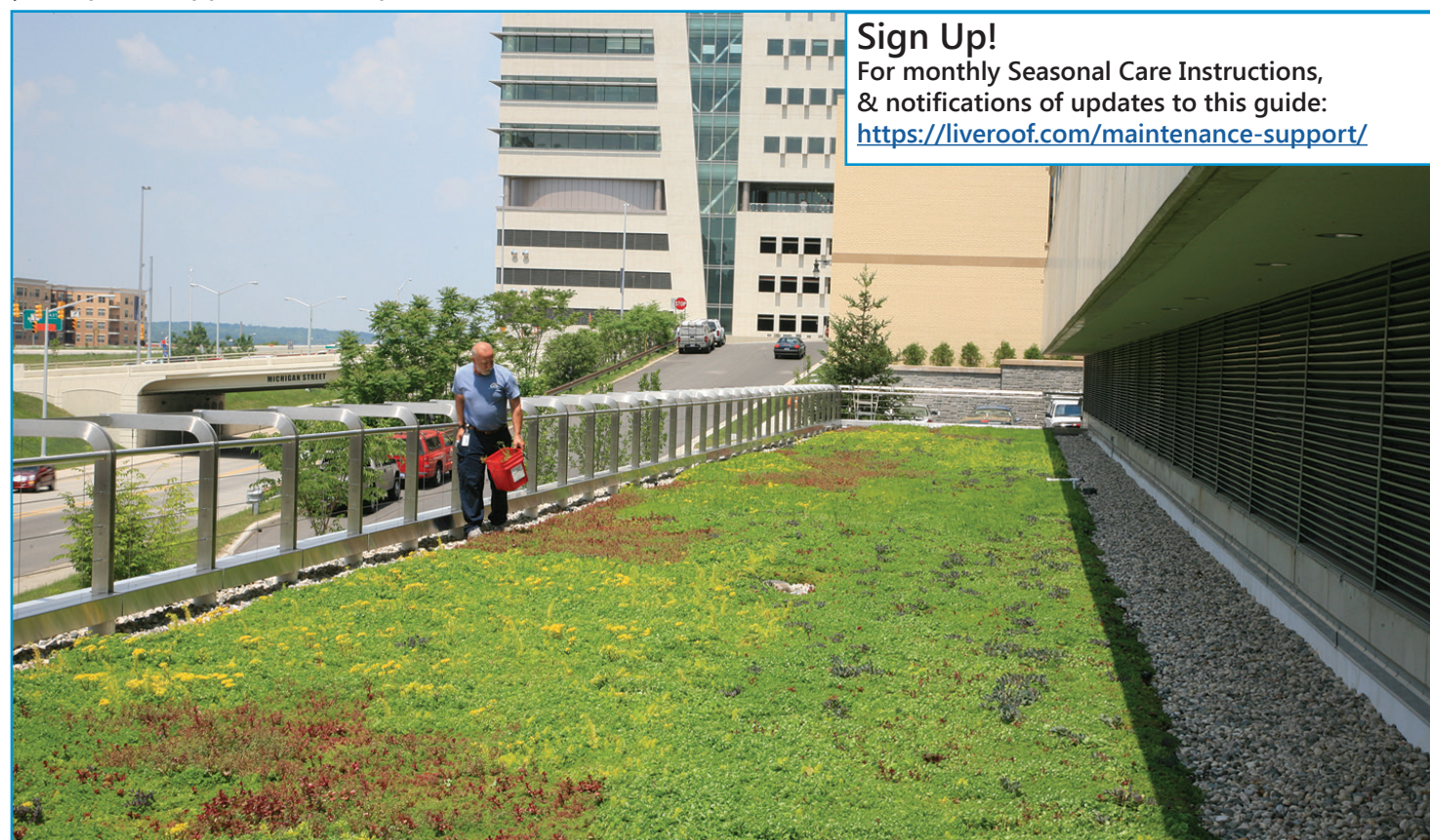
## DOCUMENTATION

Always record each maintenance event. By keeping records (in spreadsheet format), you will learn the particular nuances of caring for your LiveRoof®. A [printable log sheet](#) is included on the last page of this guide.

Name of Person	Date	Activity	Observations
		If soil test, which lab, what test, and what were the results?	
		If fertilizer, record type and amount applied per 1000 sf	
		Time needed for bi-weekly weed walk and drain inspection.	
		If irrigation, duration and weather conditions?	

The following recommendations are generally tailored to LiveRoof® systems planted with low-growing, drought tolerant succulents. Deep & Maxx systems planted with traditional landscape perennials & ornamental grasses typically have different maintenance requirements and increased irrigation needs.

Maintenance training by LiveRoof representative is required for registration of the LiveRoof® module warranty. Consult your [LiveRoof® Grower](#) to confirm maintenance recommendations / watering regimen recommended for your specific application and plant mix(es).



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<https://liveroof.com/maintenance-support/>

## Biweekly Weed Walks

Twice monthly, during any time that the roof is not frozen, conduct an inspection of your green roof system. 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 only fill up your hand with tiny weeds, this is the goal, to catch them when they are small and to prevent the development of a "seed bank" within your green roof. And, it is what keeps your total maintenance time to a minimum.

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

### PULL WEEDS

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.

By weeding every two weeks, you weed smart, not hard, and minimize the time needed for weeding. In fact, you can maintain an acre sized LiveRoof in just 30 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.

**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.**

### INSPECT FOR POTENTIAL ISSUES

Other things to check for when taking your Weed Walk:

**DISPLACED SOIL:** Nesting birds can displace soil. Any displaced soil should immediately be replaced.

**DRAIN INSPECTION:** Roof drains should be inspected every two weeks and any debris, pebbles, or leaves should be removed to keep drains flowing freely. After inspecting drains, replace lids and ensure secured against wind uplift with pins. **Failure to secure lids can result in damage or injury.**

**PLANT HEALTH:** Most plant issues are a result of watering issues. Check the soil with your finger. If it is overly dry, decrease the interval between waterings and/or check irrigation system to ensure it is running properly. If it is too wet, cut back on irrigation.

**PEST CONTROL:** Occasionally pest insects such as aphids may show up and bother the plant material, and while not commonplace, fungal problems like mildew occasionally affect green roof plants. Most pest problems are the result of an imbalance in the relationship of the pest organism and its natural biological controls (beneficial insects like ladybugs and lacewings). Many pests and fungal infirmities (like blight or mildew) are usually 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.

**Dog waste (urine and excrement) are toxic to and will kill succulent green roof plants. Therefore, unless you have a green roof that is specifically developed for dog traffic, keep dogs off the roof.**

If your green roof has been specifically developed for dog traffic, then it is likely vegetated with either a turf grass or a lily-turf, such as *Liriope spicata*. Such roofs require a minimum of 6 inches of soil (the LiveRoof deep system), and should be cared for so as to preserve the plant material. Excrement should be picked up and the plants should be watered regularly, not just for hydration, but to flush the urine from the soil.

## Water Management

In northern North America, irrigation may not be needed to keep your green roof alive during some summers, provided it is populated with Sedums and a contains a minimum of 4 ¼" soil (LiveRoof Standard modules).

- For the LiveRoof® Lite system, expect to irrigate more frequently, typically weekly during hot, dry weather.
- Likewise, the Deep (6") and Maxx (8") systems, when populated with native or conventional (non-succulent) perennials, often require very frequent irrigation.

**When in doubt, consult your [LiveRoof® Grower](#) for watering recommendations for your specific plant mix(es) and site conditions.**

In warmer climates, regular irrigation is required. Regardless of climate, LiveRoof® recommends a permanent irrigation system, as practical and efficient for the scale of the installation, as an "as needed" management tool during the hottest, driest months of the year.

**At any soil depth, prolonged hot dry weather without supplemental irrigation will result in plant thinning or death.**

HOT DRY WEATHER is generally defined as periods of 75 degree weather, with less than 1 inch of rainfall per month. This "ballpark" time period will tend to 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.

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.

**There are no absolutes when it comes to drought stress and irrigation. Check the plants for wilting, especially in the afternoon. If the plants are wilting, it is time to irrigate.**

### WATERING SEASON

Generally, the green roof system will be deactivated during traditional "winter" months, where snow or rainfall and cold weather persist. In warmer climates, irrigation may be required year round. During periods of unusually warm, dry winter weather, the green roof may need to be irrigated.

**Areas beneath building overhangs will not receive direct rainfall, thus require regular irrigation regardless of plant type and soil depth.**

### HOW MUCH WATER?

Drenching the soil periodically, just to the point of runoff, is better than more frequent, light irrigation events. Light irrigation can encourage shallow rooting and create a build-up of salts in the soil. The duration of the irrigation run and the volume of water to apply will depend upon the soil depth, and available water pressure and volume at the rooftop.

**In areas of shade, less irrigation will be required.  
DO NOT OVER WATER as this can cause widespread plant losses.**

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.



## Spring Maintenance

Spring Maintenance begins 3-4 weeks before the spring “growth flush,” which varies with locale. It is the time when plants “wake up” and grow very fast. This typically coincides with spring rain and “spring flowers” such as Forsythia, Daffodils, and Wisteria. In Tennessee, for example, it occurs around mid March, while in Minnesota it begins around mid April. In climates without cold winters, this could be February.

Resume [biweekly “weed walks”](#) and inspections. Weeds are opportunists, and many 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.

### EARLY TO MID MARCH (ADJUST EARLIER OR LATER FOR LOCAL CLIMATE)

#### PERFORM ANNUAL SOIL TEST

LiveRoof soils are formulated for sustainable nutrient content, but rainstorms and snowmelt can leach nutrients and deplete fertility. Soil testing is best conducted during late winter which leaves time to apply fertilizer, before the spring growth flush, the time when plants most 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 test kit from your testing lab. LiveRoof, LLC strongly recommends the following lab and test procedures.

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**Pennsylvania State University**, University Park, PA  
Saturated paste, pH, salts, nutrients plus percent solids & organic matter, appx. \$55

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### EARLY APRIL (ADJUST EARLIER OR LATER FOR LOCAL CLIMATE)

#### 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 NO<sub>3</sub>-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, in terms of plant vigor, is Nitrogen. If your soil contains less than a Moderate (M) amount of nitrogen, the plants will thin out and create areas of exposed soil. Therefore, if the Nitrogen level is Low, it is 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 sulphur 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 Osmocote® 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. The best of these, in our opinion, is Lesco 14-14-14 sulfur coated, available from John Deere Landscapes. If fertilizers containing phosphorus are banned from local use, we recommend Lesco 21-0-21.
- 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 21-0-21, 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 (<https://nifa.usda.gov/land-grant-colleges-and-universities-partner-website-directory>).
- 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 the application rate should be.

**Applicator assumes all risks associated with fertilizer application.**

## pH

The acidity or alkalinity of the soil is determined by its pH. Plants have a preferred pH range for optimal utilization of nutrients, and in the case of most green roof plants, this range is 6.5 to 7.0. Below 6.0 is too acid, and above 7.5 is too alkaline. If your soil pH is below 6.5, consult your soil testing lab for recommendations to increase alkalinity. Typically, this means adding lime. And, if the soil is above 7.5, it can be made more acid with elemental sulphur or an application of acidifying fertilizer, such as Lesco 14-14-14 sulfur coated fertilizer. Since LiveRoof soils are formulated to buffer against pH changes, the need to adjust pH is relatively uncommon.

## MOWING

Mowing is recommended 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). In especially humid climates (such as US Southeast), a spring trimming helps to prevent fungal issues that may result from excessive humidity buildup beneath the plant canopy. Do not mow plants in summer.

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. You can also do this with a string trimmer.

Deep and Maxx Systems: The Deep and Maxx systems are often populated with perennials and grasses. In addition to the maintenance outlined above, any non evergreen perennials should be trimmed down at this time of year to tidy them up. Vegetable plants should be removed and the soil raked smooth and any weeds removed before replanting.

## APRIL TO MAY

Continue [biweekly "weed walks"](#) and inspections, and activate irrigation system and/or adjust [watering schedule](#) as needed for changing weather.

## Summertime Maintenance

### JUNE TO SEPTEMBER (ADJUST EARLIER OR LATER FOR LOCAL CLIMATE)

Continue [biweekly "weed walks"](#) and inspections, and activate or adjust [watering schedule](#) as needed for changing weather. During the hottest, most humid months of the year, be sure to water as needed to maintain healthy plants.

## Fall Maintenance

### OCTOBER TO NOVEMBER (ADJUST EARLIER OR LATER FOR LOCAL CLIMATE)

Continue [biweekly “weed walks”](#) and inspections, and activate or adjust [watering schedule](#) as needed for changing weather.

Many weeds germinate and grow during fall. Weeding up until snow fall in cold winter climates can save a lot of work the following year. Stay off the roof if there is frost or ice. Many weeds are capable of reproducing during winter, even under the snow, so you will want to have the roof “weed-free” going into winter.

Use care to avoid walking on the plants in the presence of ice, frost or other slipping hazards.

In addition

- In climates with cold winters, DO NOT fertilize during fall. It may stimulate tender growth and compromise the cold hardiness of the plant material. In warm winter climates, without freezes, fall fertilizer may be desirable.
- 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.
- If the green roof is cantilevered with no heat under it, install heat tape or heat cable in the drains to keep the drains from freezing shut during winter.

**Deep and Maxx Systems:** The Deep and Maxx systems will likely contain vegetable, perennial, and grass species. During fall, these plants may be trimmed and tidied up for winter. Vegetable plants may be removed altogether; however, we recommend leaving the vegetable plants over the winter to prevent wind erosion. In spring, they may be removed and replanted.

## Winter Maintenance

### DECEMBER TO FEBRUARY (ADJUST EARLIER OR LATER FOR LOCAL CLIMATE)

**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. While the roof is frozen, the only winter maintenance required may be snow removal from rooftop walkways—if roof ingress 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 agents.
- In some cases, electronic heat tape or cable snow-melt systems may be appropriate, but must be installed in a manner that does not heat up the soil in modules adjacent to walkways. Take care and seek approval from the membrane manufacturer to confirm that such systems will not compromise or damage the membrane.
- 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 winter, but the weeds will not be. Therefore, you must continue biweekly “weed walks” and inspections, and activate or adjust watering schedule as needed for changing weather.

# LiveRoof Operation & Maintenance Log

Project Name	Date Installed	LiveRoof System Type(s)	Plant Mix Notes	Recommended Typical Irrigation Regimen	
		<div><input type="checkbox"/> LITE (2 ½") <input type="checkbox"/> STANDARD (4¼") <input type="checkbox"/> DEEP (6") <input type="checkbox"/> MAXX (8")</div>			
Name of Person	Date	Duration	Weather Conditions	Activity	Observations