BENEFITS OF GREEN ROOFS

STORMWATER QUALITY
Water is stored in the substrate and then taken up by plants and released into the atmosphere through evaporation and transpiration. In this way, green roofs reduce the amount of stormwater runoff and also delay the time at which runoff occurs, resulting in decreased stress on stormwater or combined sewer/ stormwater systems at peak flow periods.

HABITAT
They can be designed as integrated habitat elements, extending and supporting urban open space and nearby restoration efforts.

AIR QUALITY
A green roof filters the air moving across it, and absorbs greenhouse gases. The temperature moderating effects of green roofs also reduces demand on power plants, and potentially decreases the amount of CO2 and other polluting by-products being released into the air. Green roofs also help reduce the distribution of dust and particulate matter, as well as the production of smog.

URBAN HEAT ISLAND (UHI) REDUCTION
The heat island effect is mitigated by the daily dew and evaporation cycle. Plants on vertical and horizontal surfaces cool cities during hot summer months. The light absorbed by vegetation would otherwise be converted into heat energy. UHI is also mitigated by the covering of some of the hottest surfaces in the urban environment – black rooftops.

ECONOMIC BENEFITS & ENERGY SAVINGS
Green infrastructure benefits property values by making properties more attractive and functional. Other economic benefits are derived from green roofs through energy savings and reduced consumption. Furthermore, planted roofs protect the roof membrane from intense ultra violet degradation, mechanical damage, and expansion/contraction due to temperature extremes. By mitigating these three primary causes of failure, green roof systems result in a longer material lifespan.

RATING SYSTEMS
Green roofs help to achieve credits in Green Point Rating System and/or LEED.

WASTE DIVERSION
Green roofs contribute to landfill diversion by prolonging roof membrane life, decreasing HVAC system use, and through the use of recycled materials in the growing medium.

AMENITY CREATION
Green roofs help to reach the principles of smart growth and positively affect the urban environment by increasing green space and providing amenities.

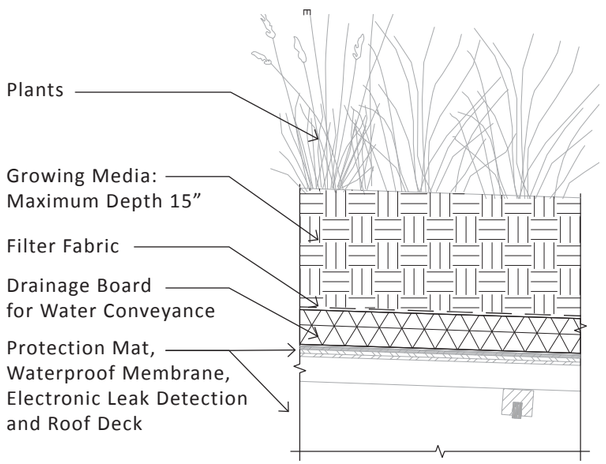
SOUND INSULATION
Green roofs have excellent noise attenuation, especially for low frequency sounds.

FIRE RETARDATION
Green roofs have a much lower burning heat load than do conventional roofs. Green roof design practices such as non-vegetated border zones, fire stops, and succulent planting reduce the risk of fire.

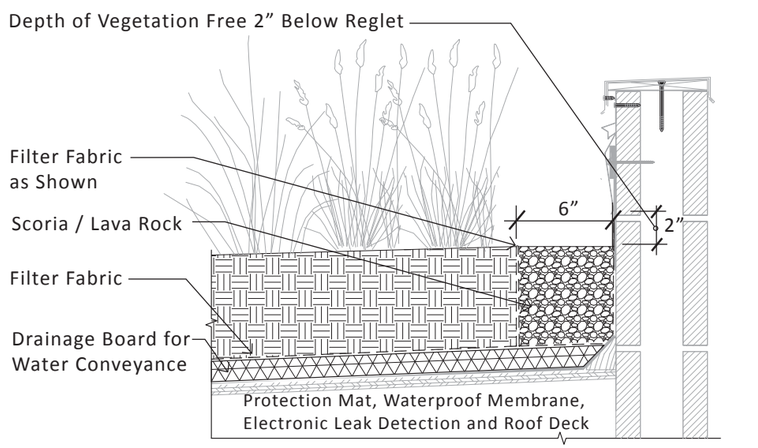
AESTHETIC IMPROVEMENTS
Urban greening has long been promoted as an easy and effective strategy for beautifying the built environment and increasing investment opportunity.

Edible gardening on a rooftop in Oakland, CA. This rendering illustrates a green roof with both intensive and extensive components.

EXTENSIVE GREEN ROOF DETAILS



Typical Extensive Living Roof Section



Typical Extensive Living Roof Section at Parapet

Image Credits: Design Ecology

INTENSIVE OR EXTENSIVE?

There are two primary categories of green/living roofs: *intensive, and extensive.*

Intensive Green Roofs

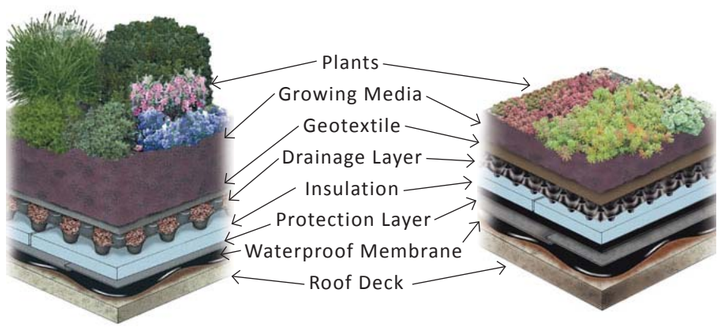
- Have deeper growing medium
- Can accommodate of a diversity of plants, including flowering shrubs and even trees.
- Are usually intended for human interaction.
- Can appear much like typical gardens on the ground.
- Architecture must be engineered for heavier structural loads.
- Are typically more expensive than extensive green roofs
- Typically require more maintenance than extensive green roofs.

Extensive Green Roofs

- Have shallower growing medium
- Use drought-resistant, shallow-rooted plants.
- Have lower maintenance requirements.
- Are usually inaccessible to the public.
- Are typically less expensive.
- Are lightweight, requiring less architectural engineering.
- Can be well-suited to native plants

Extensive green roofs are recommended for most applications in Watsonville. Many roofs with slopes of up to 33% are capable of supporting extensive green roof systems with little or no additional structural support. The growing medium of most extensive green roofs is a mineral-based mixture of sand, gravel, lava rock and organic matter. The depth is generally less than 8" deep. Due to light weight and cost considerations, extensive systems are the most common green roof application.

Typical Living Roof Components



Intensive living roof system. *Extensive living roof system.*

Image Credit: American Hydrotech, Inc.

GREEN ROOF WEIGHT

Provided here are some examples of Green Roof weights for different types of systems:

- Intensive Green Roof for Vegetables: 108 psf (18" organic/mineral substrate
- Intensive Green Roof for Herbs: 51 psf (8" organic/mineral substrate)
- Extensive Green Roof: 12 psf (2" organic/mineral substrate)
- Hydroponic Rooftop Garden: 16 psf (4" inert substrate - Perlite)

"Rooftop Resource Prototypes" - Prototype Characteristics. Credit: Bay Localize Note: These examples are conceptual prototypes and generalized building typologies drawn from the Bay Localize Neighborhood Assessment 5 and cannot be assumed to be applicable to a specific building.

MAINTENANCE REQUIREMENTS

Extensive green roofs are generally low-maintenance, although during the first year after installation plants need to be irrigated as they establish themselves. Planting hardy, drought-resistant, regionally-appropriate varieties will limit irrigation needs over the long-term since these plants are adapted to local climate.

However, shallower substrate depths tend to require some irrigation occur on a regular basis, depending on the conditions of the site and plant species selected. Subsurface drip irrigation systems or capillary irrigation can help reduce irrigation demand.

The extensive green roof needs to be inspected only a few times a year to ensure that all components, including the membrane, are functioning as intended. Extensive green roofs can reduce roof maintenance demands and as much as double the life of the roof membrane by protecting it from extreme temperature changes, ultraviolet radiation, and accidental damage.

ADDITIONAL RESOURCES

Green Roofs for Healthy Cities. www.greenroofs.org

FLL Guidelines. The FLL (Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V.) is the German Research Society for Landscape Development and Landscape Design.

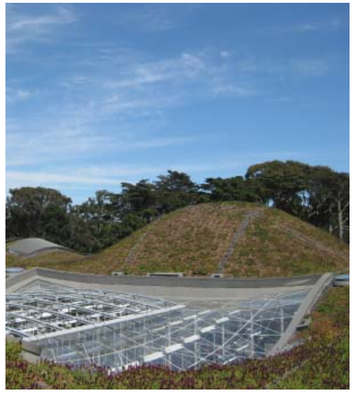
Tapping the Potential of Urban Rooftops, Rooftop Resources Neighborhood Assessment. Study provided by Bay Localize. www.baylocalize.org

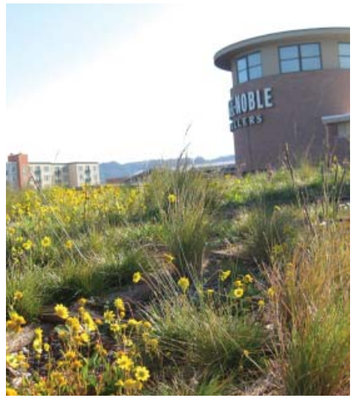
ASTM Standards, Volume 04.12. Standards E2396 - E2400

ANSI/SPRI VF-1: External Fire Design Standard for Vegetative Roofs. Single Ply Roofing Industry (SPRI), 2010. Access through Green Roofs for Healthy Cities, www.greenroofs.org. "Green Roof Benefits". http://www.greenroofs.org/index.php/about-green-roofs/green- roof-benefits. Click on "Fire Design Standards" under "Private Benefits" for link to PDF

GREEN ROOFS

A PART OF THE **WATSONVILLE URBAN GREENING PLAN**





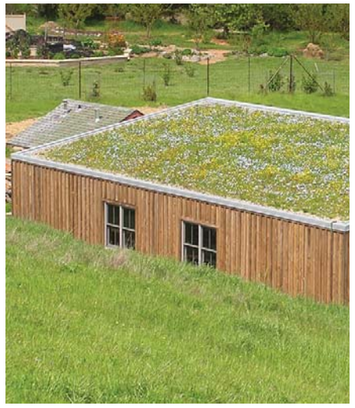


Photo Credits: Design Ecology, Rana Creek, David Baker + Partners

City of Watsonville

"Opportunity through diversity; unity through cooperation"