

## Not All Green Roofs Are Green

Long term case study of Green Roofs in the Bronx, NY  
Green Roof Service LLC / Green Roof Technology 2009

**The Bronx Initiative for Energy and the Environment (BIEE)** was established in 2003 through a Memorandum of Understanding between the Bronx Borough President, Adolfo Carrion, Jr., BOEDC and the New York Power Authority. In response to South Bronx asthma rates seven times the national average, high rates of diesel pollution and chronic CSO problems, BIEE committed \$1.09 million for fifteen (15) green roofs in the South Bronx, and nine (9) have been installed to-date (2009) more than any other borough in New York City. In addition, BIEE committed funds for a 10,000 square foot demonstration green roof, installed on the Bronx County building in June 2006. BIEE engaged Green Roof Service LLC, German landscape architects and Green Roof Experts with 30+ years of experience, in designing extensive green roof according to the German FLL \* Green Roof Guidelines. We also leveraged funding from the Environmental Protection Agency (EPA) to install monitoring boxes on the Bronx County green roof for two years' tracking of stormwater retention and temperature of the green roof system and a control roof.

BIEE also engaged Green Roof Service LLC / Green Roof Technology to monitor the funded green roofs. The projects, all installed on non-profit facilities, are diverse in the type of green roof systems employed, range in cost from \$16 to \$43 per square foot, and exhibit widely divergent results. All of the roofs were installed 2006 or earlier and have been monitored since March 2007.

The goals of the monitoring program are to prevent failures through training and problem-solving, and to monitor how the funded roofs perform and develop. The roofs have been evaluated in respect to general appearance, plant growth, sustainability, maintenance, growing medium, irrigation and drainage. Although the evaluation has not been done on a scientific basis, results are clear and instructive.

At this early stage of the American green roof industry, "Lessons learned" can be critical for future projects. With green initiatives and interest in green roofs blossoming in many U.S. cities, including the recent announcement of New York City's PlaNYC, policymakers are looking for guidance on requirements for green roof installations and maintenance. The Bronx experience-with multiple green roofs and divergent systems and results-provides critical background for evaluation and development of minimal standards for green roof specifications to ensure the sustainability of green roofs in the United States.



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So what are the lessons learned?

First and foremost, if the specifications for the growing medium are inadequate, the plants will not thrive. The balance between organic and inorganic components, particle sizes, nutrients, and several other properties must be able to promote and sustain plant life. The best way to ensure healthy plants is to use growing medium compliant with respective requirements defined in the FLL Guidelines. (There are standardized growing media available in the U.S, such as Rooflite™, which comply with FLL standards.) The depth of the growing media or soil medium should be a minimum of 2", although 4" is optimal for plant health and stormwater retention benefits. In five of the monitored roofs, their poor performance can be traced to inadequate composition and/or depth of the green roof soil medium.

The second greatest area of concern is maintenance. It is critical that there be appropriate irrigation and weeding in the first two years after installation. If planted in late spring/early summer and there is a hot, dry summer, the green roof must be irrigated. However, over watering can cause roots to rot and/or prevent the plants from spreading their roots as they seek water. The Bronx County building, we have been watered for only 30 minutes every third day during the first summer; no irrigation was necessary in year two and until today.

Another roof planted the same month had no spreading of plants after they were watered daily for 45 minutes. Also, weeds must be eliminated carefully and regularly, as some grow much faster than Sedums. If the weeds that show up on every newly installed green roof get a chance to spread seeds, they might take over and dramatically increase further maintenance efforts. After two years of proper care the Sedums will cover the ground completely. This will minimize the need for further maintenance.



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We recommended these minimal standards for extensive green roof specifications to the NYC Mayor's Office:

- Five year track record of the green roof system or compliance with the German FLL Guidelines.
- Root resistant waterproofing membrane or a separate root barrier.
- Protection fabric above waterproofing membrane.
- Provision of solid pavers (i.e. concrete pavers) in all areas designated for walking.
- Clearly defined drainage layer with drain inspection boxes.
- FLL-compliant growing medium.
- Depth of the entire green roof system 4 inches minimum.
- 80+% of the plants should be Sedums.
- At least 6 Sedum varieties.
- Two Year maintenance plan – minimum.

We don't have 20 years to play trial and error with green roof systems; global warming precludes that luxury. Let's employ what has worked already, in order to ensure sustainable green roofs and a healthy green roof industry.

**The following projects were part of the case study:**

Project Name: <b>Abraham House</b> Address: 348 Willis Ave Bronx, NY 10454 Green Roof Design: <b>1100:Architect</b> Green Roof System: Garland Installation: Spring 2006	Project Name: <b>Grand Parent Apartments</b> Address: 951 Prospect Avenue Bronx, NY 10459 Green Roof Design: <b>Earth Pledge</b> Green Roof System: Soprema Installation: Spring 2006	Project Name: <b>St. Simon Stock School</b> Address: 2191 Valentine Avenue Bronx, NY 10457 Green Roof Design: <b>The Gaia Institute</b> Green Roof System: The Gaia Institute Installation: Spring 2005
Project Name: <b>Supreme Court</b> Address: 851 Grand Concourse Bronx, NY 10454 Green Roof Design: <b>Green Roof Service LLC</b> Green Roof System: Optigreen, Installation: June 2006	Project Name: <b>Fordham Bedford Housing</b> Address: 2241 Webster Avenue Bronx, NY 10459 Green Roof Design: <b>Earth Pledge</b> Green Roof System: XeroFlor Installation: Summer 2005	Project Name: <b>Prep Charter School</b> Address: 3872 Third Avenue Bronx, NY 10457 Green Roof Design: <b>Weston, GreenGrid</b> Green Roof System: GreenGrid Installation: September 2006

\*Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e. V. (FLL). 2002. Guidelines for the Planning Execution and Upkeep of Green Roof Sites

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