

GREEN ROOFS FOR HEALTHY CITIES

SUMMER 2011
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LIVING ARCHITECTURE MONITOR

WILD-BEE DESIGN

THIN FLATS - A MODEL OF
SUSTAINABLE DESIGN

A GREEN-ROOF GARAGE:
SEVEN YEARS LATER



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SKY GARDEN AT THE VISIONAIRE

GROWING FOOD 35 FLOORS
ABOVE NEW YORK HARBOR

ON THE COVER

Sky Island at the Visionaire. Image by Roger Swingle, Inter Vision New Media. Image courtesy of Mark K. Morrison.

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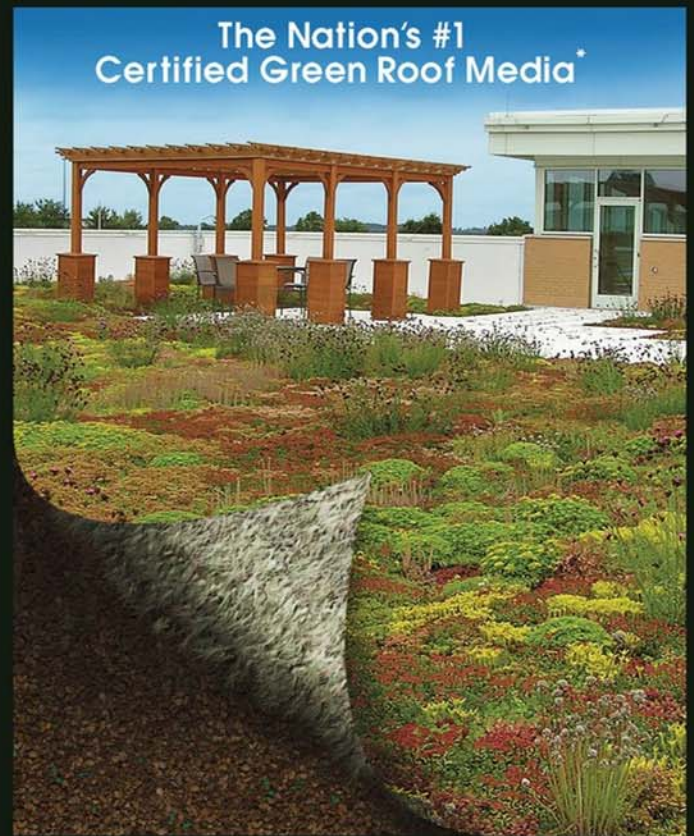
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Image courtesy of Mariko Reed

THIN FLATS

THE FIRST PLATINUM-CERTIFIED DUPLEX UNDER THE USGBC'S LEED FOR HOMES PROGRAM, RESIDENTS OF THIS PHILADELPHIA'S NORTHERN LIBERTIES NEIGHBORHOOD ENJOY AN OUTDOOR LIVING ROOM WHILE KNOWING THEIR HOME IS ALSO A MODEL OF MODERN, INTEGRATED SUSTAINABLE DESIGN

By Howard B. Steinberg

Over the last decade, Philadelphia's Northern Liberties neighborhood has been in a state of transformation becoming one of the City's most vibrant communities with the development of new residential and retail projects, parks and community gardens. Merging this trend with the City's ever expanding focus on sustainability through its newly created *Green Works Plan* (a comprehensive sustainability roadmap strategy addressing energy, environment, equity, economy and engagement), and the Philadelphia Water Department's leadership in emerging stormwater management practice guidelines, new incentives and efforts in

the public sector continue to be generated to encourage implementation of more sustainable building practices within the City.

One of the leading private development efforts has been Onion Flats, a Philadelphia-based development, design-build collective, which has taken on sustainability as an inherent language within their practice. Since 1997, well before the City or the U.S. Green Building Council honed its Leadership in Energy and Environmental Design (LEED) program, Onion Flats had been developing urban infill projects which repeatedly prove its mantra that energy efficiency, sustainable building practices and quality design need not cost any more than comparable projects that ignore these

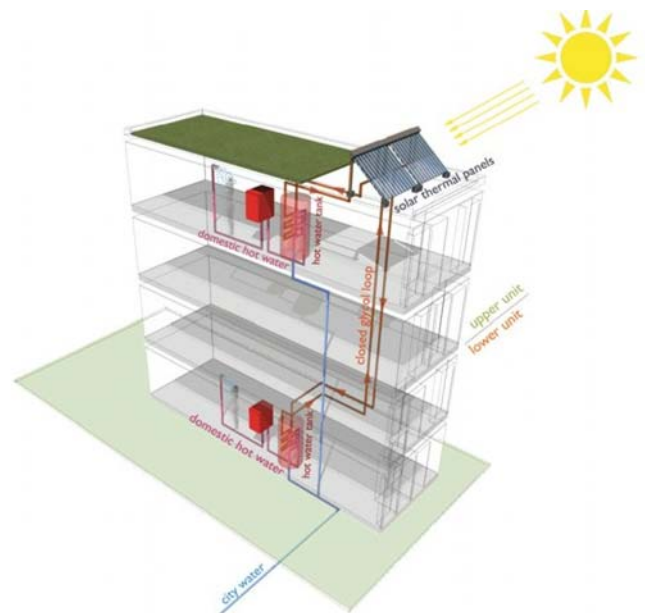
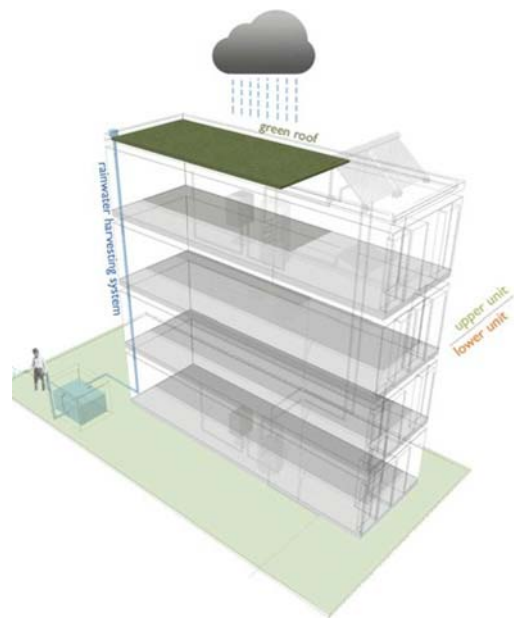
fundamental precepts. Their goals are achieved through a holistic approach to development, utilizing all of the inherent efficiencies of a fully integrated design-build team. By focusing their detailing around energy-efficient building envelopes and simplifying rather than intensifying the buildings' system technology, Onion Flats' buildings use significantly less energy and provide decidedly healthier indoor environments than what is required by the international building codes.

One of Onion Flats' recent Northern Liberties' projects, "Thin Flats," is a nine-unit condominium made up of four duplexes and one single-family residence. The project became the first duplex development in the country to achieve LEED Platinum certification under the LEED for Homes program. Thin Flats has also won numerous awards. Most notably, a 2009 AIA Philadelphia "Honor Award", a 2010 "Global Awards of Excellence" from the Urban Land Institute, bestowed to only five projects in the world, and more recently a 2011 Green GOOD DESIGN™ Award from the European Centre for Architecture Art Design and Urban Studies and The Chicago Athenaeum Museum of Architecture and Design: all recognize the project for its architectural innovation and as a shining example of highly sustainable building practices.

Within its practice, Onion Flats appreciates the tremendous value of green roofs, particularly in urban environments where outdoor green space is at a premium and stormwater management has reached a critical tipping point. From a city planning perspective, older cities as Philadelphia grapple with the challenges of old infrastructure, particularly in the area of combination sewer and stormwater systems. Approximately 40 to 60 percent of Philadelphia's 130-square-miles are managed by these combined sewers. As new development occurs, dramatic increases in impervious surfaces are created from both rooftops and the surrounding pavement. This in turn generates significantly more stormwater runoff that has traditionally been directed into these antiquated and undersized pipes, forcing them to back up and send sewage into the rivers and streams. In Philadelphia, the combined sewer overflow (CSO) discharges approximately 1.7 billion gallons annually. Additionally, sending fresh rainwater into the combined sewers rather than having it recharge into the ground naturally, necessitates significantly greater water treatment which is costly, wasteful and unnecessary.

Given the enormity of the stormwater challenge, the green roof on Thin Flats is an integral part of the architecture and sustainable design of the project. It serves as an integral component of the building's energy envelope by providing a buffering mass on the rooftop which deflects solar heat gain in the summer months and helps diminish rooftop freezing temperatures during the winter months, effectively reducing the energy needed to heat and cool the homes. The green roofs provide outdoor "living rooms" for the upper condominiums while rear yards serve the lower units. These "rooms" offer tremendous views of the Philadelphia skyline and provide a green oasis for the residents. The buildings' parapet walls are capped with planter extensions, planted with ornamental grasses, and provide privacy screens from the neighboring spaces.

Thin Flats incorporated an intensive Savannah® Roofmeadow® green roof system over a two-ply modified bitumen waterproofing and a loose laid EPDM root barrier. The roof utilizes a dual media system made up of two inches of drainage media at its base and 6"-12" of growing media above, and is planted with *Sedum*, perennials and ornamental grasses. Because green roofs virtually eliminate the freeze-thaw cycles of the roof membrane, protecting it from surface abrasion and ultraviolet degradation, waterproof membranes are expected to last two- to three-times as long as those exposed to the physical elements.



THIN FLATS' CLOSED LOOP WATER SYSTEM CAPTURES RAINWATER TO HELP EASE PHILLY'S STORMWATER CHALLENGES.

NATURAL IRRIGATION

As with all green roofs, the intention is to capture and mitigate as much rainfall as possible through media absorption, plant watering and evapotranspiration. Once a green roof system is fully saturated, however, the overflow water bypasses the roof, and in the case of Thin Flats, is captured downstream in a sub-grade rainwater harvesting tank. This water provides a source of irrigation for the development's vegetation. In systems which do not use rainwater capture, the green roof slows the peak attenuation of the stormwater surge on the sewer system, giving it a chance to dissipate before this additional volume enters the public system, reducing the

potential for CSO discharge into the city's rivers.

For the type of green roofs installed on Thin Flats, modeling using the RWS (German) program leads us to expect that the annual volume of runoff, relative to rainfall, will be reduced to about 20 percent of that expected without a green roof. However, this benefit is not distributed equally around the seasons, with reduction to 44 percent in the winter and nine percent in the summer. It is worth noting that green roofs are no different than other Low Impact Development (LID) measures, in that they are more effective in summer than winter. The ability to reduce peak runoff rates and to filter runoff is not as strongly influenced by the season. Based on long-term modeling using actual rainfall data from Philadelphia it is predicted that the runoff rate coefficient (peak runoff rate / peak rainfall rate) will be about 0.30 for the one-year probability rainfall event, and 0.45 for the 10-year probability storm.

Philadelphia has made great strides toward incentivizing green roof installations. Commercial property owners can take advantage of a green roof business tax credit equivalent to 25 percent of the cost of the green roof up to USD \$100,000, and by definition of the "green roof," this includes the waterproofing membrane; a significant portion of the total installation cost since the selected membrane is integral to the green roof design. Residential properties, however, do not yet have this incentive. Additionally, the Philadelphia Water Department (PWD) has implemented a "green review" process for both commercial and residential projects which moves the stormwater application to the top of their pile for an expedited review, enabling a faster roadmap to moving through the project permitting process. This can be a significant benefit to the property developer. In July, 2010, the PWD began incrementally transitioning over a four year period to a parcel area-based billing system to capture stormwater related treatment costs from its customers, and in turn, offering fee credits, up to 100 percent, for approved stormwater management practices (SMPs). These credits, however, are only available to non-residential and condominium properties which have commonly owned areas. Thin Flats, composed of four duplexes and one single family home, did not qualify for these fee credits.

Although all of the known benefits of incorporating green roofs into a project far out way the challenges, residential development often poses warranty hurdles. As with any backyard garden, plants require ongoing care; the beds must be weeded, watered and proper nutrition applied. In the commercial green roofing world, it is much more viable to implement an ongoing maintenance program with a single building owner to ensure that the green roof is properly maintained over its lifespan, however, in a

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for-sale residential project without a homeowners or condominium association, as is the case of Thin Flats, multiple owners with varying degrees of care and interest may be responsible for their green roof gardens. It can be difficult to ensure the long-term success of the green roof system if the owner is unwilling to consistently follow proper maintenance guidelines or to hire a professional to care for their system.

The Thin Flats' green roofs work in unison with a well-insulated and airtight exterior envelop which is the most effective and cost-efficient method for reducing energy consumption. Fresh make-up air is maintained in the homes through the use of Energy Recovery Ventilators (ERV) which effectively capture heat from the houses' exhaust systems and temper incoming fresh air from the outside. The rooftops incorporate solar thermal arrays which deliver hot water to the homes' radiant heated floors and domestic hot water. In its practice, Onion Flats continues to explore the typology of the Philadelphia Row house which is historically a long, narrow building and often very dark at its core. Through the use of a glass floor beneath the rooftop skylights, and interior clerestory windows within the inner spaces, natural light showers these rooms eliminating the need for artificial lighting during the daytime hours, further reducing energy consumption. This combination of common-sense passive solar design, a super-insulated and airtight thermal envelope, along with low-tech mechanical systems, the energy consumption in these homes has been reduced by 65 percent of a typical home designed to building code standards.

Howard B. Steinberg, AIA, LEED AP, is principal of Onion Flats LLC, Plumbob LLC, JIG Inc., G.R.A.S.S. and BLOX Sustainable Building Systems, a collective of development, architecture, design-build and manufacturing companies based in Philadelphia, Pennsylvania. G.R.A.S.S., an acronym for Green Roofs and Solar Systems, is the construction arm of Onion Flats; it partnered with Philadelphia-based Roofmeadow, a nationally recognized green roof consulting firm headed by Charlie Miller, to incorporate the green roofs for the Thin Flats project.

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